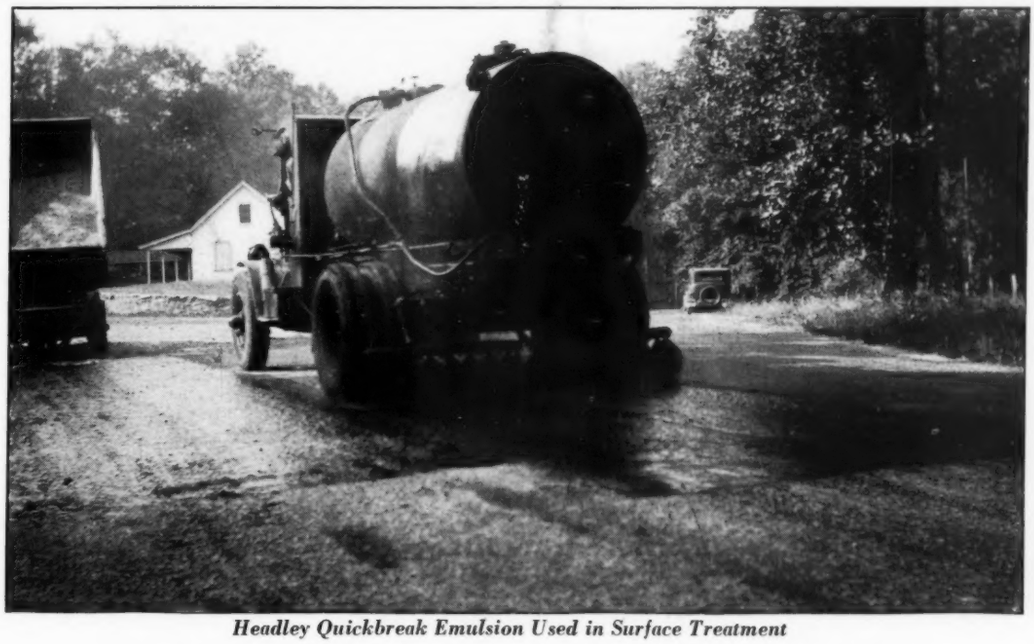
*City, County and State*

# PUBLIC WORKS

**Sewerage and Sewage Treatment** | **Highways and Streets** | **Water Supply Refuse Disposal** | **Construction and Engineering**



*Headley Quickbreak Emulsion Used in Surface Treatment*

## PRE-MIXED • MIXED-IN-PLACE
## PENETRATION • SURFACE TREATMENT

For 25 years Headley Emulsions have been known for their splendid performance. You can get a type of Headley Emulsion to use in any season. And any one of them will give you these advantages:

1. They require no heating
2. Can be mixed by hand or machine
3. Require no curing
4. The aggregate may be wet or dry
5. Will not bleed nor become brittle
6. They will "stay put"
7. Use them for repairing or complete resurfacing

Write for free bulletin giving full information about Headley Emulsions for highway construction, maintenance and repair of all types. Address our nearest jobber or Headley Asphalt Division, Sinclair Refining Company (Inc.), Marcus Hook, Pa., P. O. Box No. 66.

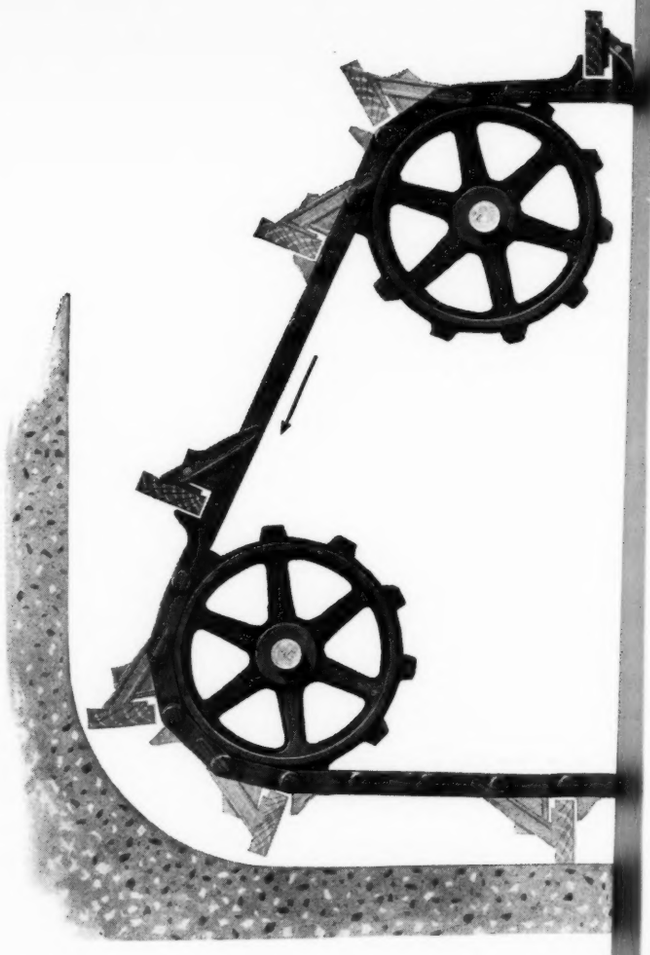
**ASPHALT IN EVERY FORM**

***For Highway and Street Construction Maintenance and Repair***

# HEADLEY ASPHALTS

REG. U.S. PAT. OFF.

**FEBRUARY, 1934**



# Now...

## A Positive Discharg

In the conventional design of Conveyor Type Sludge Collectors for Sedimentation Tanks the flights are attached in a fixed position to the chain. This construction causes the flights to act as a scoop or bucket in passing from the horizontal to the vertical at the influent end of the tank, and tends to convey the sludge to the surface instead of properly discharging it into the hopper. This is especially true if the sludge hopper becomes full or if there is a tendency for the sludge to hang on the flight. This is often the case with primary sludge.

Keen to recognize this fault, Jeffrey Engineers have developed a positive discharge or dumping flight, so designed that . . .

"As the flight passes around the lower corner sprocket at the influent end of the tank it dumps through an angle of 90° thus positively discharging the accumulated sludge in front of the flight into the sludge hopper. This dumping action causes the flight to ascend with its narrow edge upward instead of its broad width. As the flight passes around the upper corner sprocket at the influent end it is automatically turned into normal position for skimming."

Recent installations using this New Type Discharge Flight (see drawings and photographs above) have proved that it is a decided advantage over the old method, the flights coming to the surface perfectly clean and free of all sludge.

If you interested in the latest development in Sludge Removing Equipment for your Sewage Disposal Plant . . . let us tell you more about this New Conveying Flight, which actually dumps the accumulated sludge into the hopper rather than relying upon gravity for its discharge.

*Our Jeffrey Engineers will help you in handling adequately and effectively your sewage disposal problems. Write today.*

## THE JEFFREY MANUFACTURING COMPANY

947-99 NORTH FOURTH STREET — COLUMBUS, OHIO, U. S. A.

NRA MEMBER U.S. WE DO OUR PART



VOL. 65 — PUBLIC WORKS — No. 2

Entered as second-class matter at the Post Office at New York, N. Y., Sept. 1, 1922, under the act of March 3, 1879.
Published Monthly by PUBLIC WORKS JOURNAL CORPORATION, 310 East 45th St., New York, N. Y.
SUBSCRIPTION RATES: United States and Possessions, Mexico and Cuba, $3.00. All other countries, $4.00.
FEBRUARY, 1934

*February 1934*

# PUBLIC WORKS

*Vol. 65 No. 2*

CITY, COUNTY AND STATE ENGINEERING AND CONSTRUCTION

TABLE OF CONTENTS FOR FEBRUARY, 1934

**Civil Works and Public Works:**

Highway Beautification by CWA ..... 12
CWA Work to Be Discontinued ..... 27

Editorial ..... 27

**General:**

Engineers as Divers ..... 17
Diesel Tractors Give High Fuel Economy. *By Ralph J. Morgan* ..... 28
Key Maps and Master Plan for a City Engineering Office. *By William W. Reeder* ..... 24

**Highways and Pavements:**

Highway Beautification by CWA ..... 12
Handling 54,000 Barrels of Cement on a Highway Job ..... 18
Drags Used in Mixed-in-Place Construction ..... 20
Soil Materials Suitable for Mudjacking ..... 13
Road Maintenance Costs in Rhode Island ..... 23
Highway Construction Novelties ..... 29
Road Saved from Meandering River by Blasting Cut-off ..... 30
Getting Highway Equipment ready for Spring ..... 31

**Refuse Collection and Disposal:**

Incinerator and Sewage Works Combined for Canajoharie. *By Henry W. Taylor* ..... 9
Improving Refuse Collection and Disposal ..... 41

**Sewerage and Sewage Treatment:**

Incinerator and Sewage Works Combined for Canajoharie. *By Henry W. Taylor* ..... 9
Planning and Financing Sewage Treatment in Birmingham ..... 15

**The Digestion Tank:**

Preventing Acid Pollution of Streams by Abandoned Mines ..... 26
Sewereage in Nagoya and Kyoto, Japan. *By Isador W. Mendelsohn* ... 39
Sewers 4500 Years Old ..... 35
Germany's Climate and Sanitation ..... 39
Assessing Damages for Sewage Pollution of Rivers ..... 40

**Water Supply and Purification:**

Solving Boulder Dam Problems ..... 11
Code for the Water Supply Industry ..... 20
The WATER WHEEL ..... 21
Full Moon for Leakage Tests ..... 14
Zinc in Water Supplies Not Poisonous ..... 35
Laying a 42-Inch Water Main Across a River ..... 35
Net Water Works Income Six Percent of Total Investment ..... 36
Arc Welding of Milwaukee's Standpipe ..... 36

**Departments:**

Timewasters ..... 7
Industrial Literature ..... 47
Engineering News ..... 45
New Equipment ..... 50

## TIMEWASTERS

**More Complaints:**

*Further complaints continue to seep in about the true-to-name character of* TIMEWASTERS. *Linn Enslow, ye editor of our esteemed contemporary* WATER WORKS & SEWERAGE, *says that the morning* PUBLIC WORKS *comes in, there is a good four or five hours gone, and he doesn't solve them all even then. And good Doc Rudolfs complains bitterly that five of his young men will spend five hours each on the same problems, without advancing one whit the science or art of sewage treatment. Somehow or other, though, we don't feel the least bit sorry. Mental discipline, after all, is valuable.*

**Match This:**

Below are shown what our artist purports to represent 7 matches. The problem is to make the equation correct by changing one match. This little jewel was contributed by R. S. Rankin of the Dorr Co.

**Putting the Bag:**

Without at this time giving the answer to the beggar problem of last month, we will make it a bit easier by telling you that the beggars can, *and do*, borrow coins from each other. Also, that there was some very heavy bag-throwing and high speed counting.

**Those Magic Squares:**

Brought but one answer—from S. Cameron Corson, of Norristown, Pa. The solution follows: Since each line adds to 175, the sum of all the numbers = 5x175, the sum a series of 25 numbers with common difference of 2. The numbers are 11, 13, — — — — 59. Two methods of arranging are shown.

| No. 1<br>Our arrangement | No. 2<br>Corson's arrangement |
|---|---|
| 43—57—11—25—39 | 31—57—23—49—15 |
| 55—19—23—37—41 | 17—33—39—25—41 |
| 17—21—35—49—53 | 43—19—35—51—27 |
| 29—33—47—51—15 | 29—45—11—37—53 |
| 31—45—59—13—27 | 55—21—47—13—39 |

The numbers are placed in order, following diagonals upward in solution No. 1 and downward in No. 2. On hitting a square already occupied, drop vertically to the next square in No. 1; drop vertically two squares in No. 2. On reaching the side, conceive the square to be wrapped around a vertical cylinder so that the two sides coincide, and continue along the diagonal; on reaching the top or bottom, conceive it wrapped around a horizontal cylinder.

SUBSCRIPTION RATES: United States and Possessions, Mexico and Cuba, $3.00. All other countries, $4.00. Single Copies, 35 cents each.

**A. PRESCOTT FOLWELL,** *Editor* **W. A. HARDENBERGH,** *Asso. Editor*

Published monthly by the PUBLIC WORKS JOURNAL CORPORATION, 310 E. 45th St., New York, N. Y. J. T. MORRIS, *President;* W. A. HARDENBERGH, *Vice-Pres.;* CROXTON MORRIS, *Treasurer. Advertising representatives,* S. N. HUME, 310 East 45th St., N. Y.; FRED R. JONES, 100 No. La Salle St., Chicago, Ill.; ALONZO HAWLEY, 1760 E. 22nd St., Cleveland, Ohio.

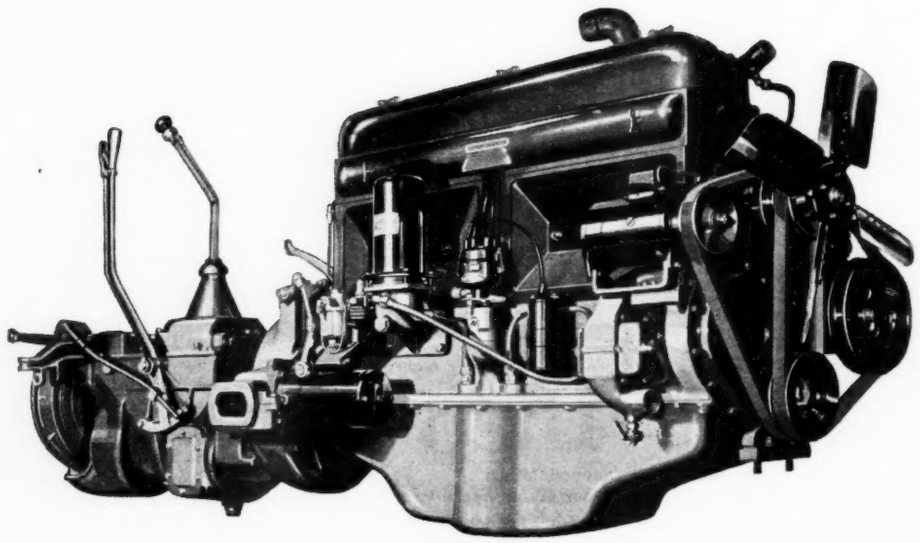
**FOUNDED IN 1896**

## GENERAL MOTORS TRUCK COMPANY

***presents***

# A NEW ENGINE

## GMC 450



**DEVELOPING** the highest sustained torque of any truck engine in its capacity range . . . and delivering maximum torque from 800 to 1200 r.p.m. . . . the new GMC 450 engine fully maintains the reputation for capability which the GMC line has established. In spite of its 120 horsepower, developed at 2300 r.p.m., this new 450 is characterized by *high* operating economy.

Like its companions, the new GMC 450 power plant is of 6-cylinder valve-in-head GMC design. Its features and improvements include down-draft carburetion; crankcase ventilation; oil temperature regulator; full pressure lubrication; and airplane type, steel backed, copper lead alloy precision bearings.

The GMC 450 is designed for heavy duty service. Completely truck-engineered and truck-built, it is a worthy addition to the famous group of GMC truck engines.

### CHECK THESE FEATURES OF VALUE—ECONOMY—DEPENDABILITY

**1** The highest sustained torque in its capacity range—340 ft. lbs. at 800 to 1200 r.p.m.

**2** 120 horsepower at 2300 r.p.m.

**3** GMC valve-in-head design—for greater power and efficiency.

**4** Down-draft carburetion—for maximum torque over a wide speed range.

**5** Roller bearing centrifugal water pump—front mounted to provide large generator space.

**6** Crankcase ventilation—to maintain oil quality.

**7** Oil temperature regulator—to protect bearings by keeping oil temperature at normal.

**8** Full pressure bearing lubrication.

**9** Tulip type exhaust valves, stellite seats.

**10** Balanced and counter-weighted four-bearing crankshaft.

**GENERAL MOTORS TRUCKS and Trailers**

GENERAL MOTORS TRUCK COMPANY — *Time Payments Available Through Our Own Y. M. A. C.* — PONTIAC, MICHIGAN


Do you make regular use of the Readers' Service Dept.?—see pp. 47-49

PUBLIC WORKS

*City, County and State Engineering and Construction*

Vol. 65 *February, 1934* No. 2

# Incinerator and Sewage Works Combined for Canajoharie

By Henry W. Taylor

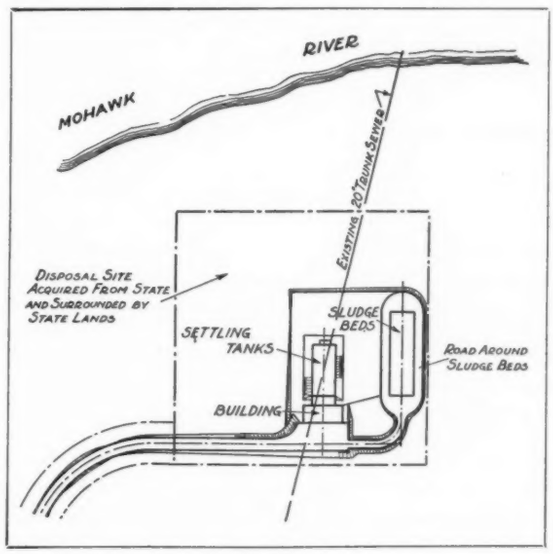
THERE has been a decided lag in undertaking proper and permanent methods of garbage and refuse disposal as compared with the progress of sewage disposal in many municipalities. There are many reasons why a combination of these two utilities might well be considered. The following instance of a combined wastes disposal plant will serve to illustrate the feasibility of the combination.

The village of Canajoharie, New York, made application in September, 1933, for a PWA loan and grant to construct a wastes disposal plant, consisting of an incinerator for garbage and refuse and a sewage treatment works including primary treatment only. An acute need had developed in the last few years for a permanent method of disposing of garbage and refuse of the village. Available dump areas for crude disposal of these wastes were becoming exhausted, and the installation of an incinerator had been in the foreground of proposed municipal activity when the National Recovery Act was passed in June. It was also considered by the village authorities that it would be only a short time before they would be urgently requested by the State Department of Health to install a sewage treatment works and discontinue the discharge of raw sewage into the Mohawk river. Since neither of these projects had been started, there was every reason for planning them as a combined unit, with the exchange of heat values, on a single location, with one corps of attendants and other advantages.

Theoretically, there are several advantages in making such a combination of two utilities, and the theory of the combination proves out in this particular case. Combined construction is generally more economical than two separate installations. Only one site and one land purchase is involved in the combined plant. One operator or one corps of operators can easily handle the combined wastes disposal plant since the two projects lend themselves to combined operation, especially in the case of small plants. There is an opportunity for exchange of heat values, in that the flue gases from the incinerator can be used to heat water to maintain the requisite temperature in the sludge digestion tank of the sewage treatment works, while the gas from the sewage treatment works can well be utilized as an auxiliary fuel for the incinerator. The combination of plants also renders it convenient to incinerate the dry sludge in case it is desired to do so. As a matter of supervision more effective oversight can be maintained on this combined unit than if there were two isolated units. In the case of the small plant, the cost of building two separate units and of two sites would be more than adequate to install a combined plant which is far more creditable in its appearance and facilities.

The existing trunk sewer from the village of Canajoharie to the Mohawk river extends through State lands. The village was able to purchase a plant site from the State and in a location above high water levels, away from either industrial or residential developments and surrounded by State lands which are used exclusively as a spoil area. Such a site affords complete protection against either industrial or residential encroachment and gives a permanent isolation. The plant itself is about 700 feet from the nearest farm house and at the same time is more accessible than available refuse and garbage dumps.

The main building of the plant was designed with the incinerator process at one end and the sludge digestion process at the other end, while screening, pumping and other sewage process equipment is located in the center of the building. The settling tanks are in the rear of the building, and sludge drying beds parallel to the tanks. The first floor of the building contains the incinerator and stoking room, a hallway, the sludge digestion tank, and the motor room for sewage pumps. The second floor of the building contains the loading room for the incinerator, central hallway, office and the upper part of the digestion tank.




*General lay-out of Canajoharie plant*

### *The Incinerator*

The incinerator is designed for a capacity of six tons in a period of eight hours and is equipped with a chimney about 70 feet

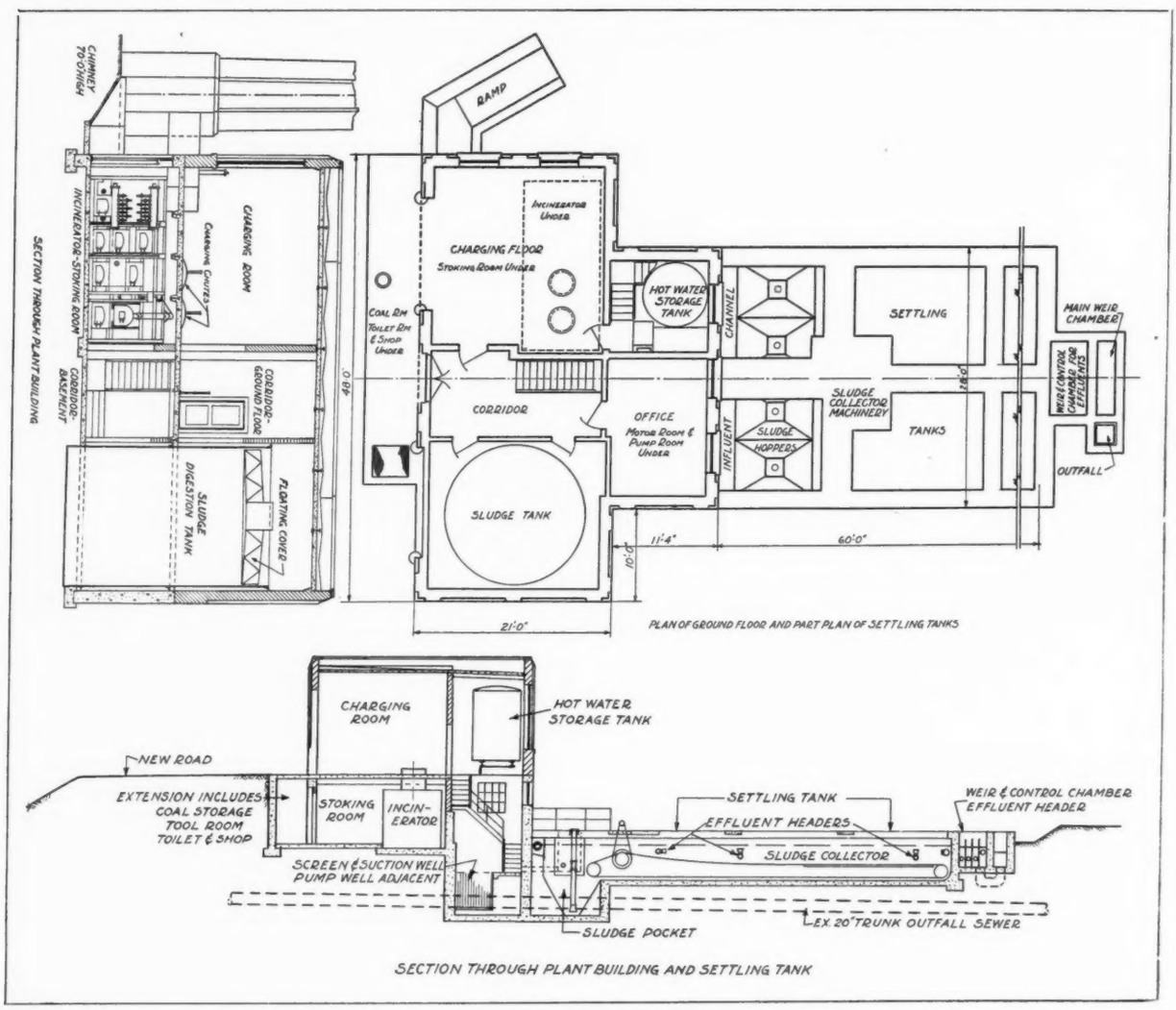
high. A Morse-Boulger incinerator is shown on the drawings. The chimney was designed in collaboration with the American Chimney Corporation of New York City. The village has a municipal refuse and garbage collection service. As the refuse collection includes practically anything that can be placed at the curb of the property, the percentage of combustible materials is large. The daily quantities of both garbage and refuse are fairly large, due in some measure to the Beech-Nut Packing Company plant, which is located in Canajoharie. Past records indicate a probable average of five tons of combined garbage and refuse per day for six days of the week. The capacity of the incinerator is sufficient to avoid surcharging, though the rate of delivery of garbage and refuse may be high. The maintenance of both units of the plant is confined to eight hours.

Pipe coils are to be installed in the last combustion chamber of the incinerator and these coils are connected to a hot-water storage tank which has a capacity sufficient to supply the sludge tank with hot water for its heating coils throughout twenty-four hours of the day, although the incinerator is used only eight hours. The storage tank will be controlled by thermostatic valves so that, while the temperature in the hot water tank may rise as high as 200 degrees, the circulating water delivered to the sludge tank heating coils will be maintained at a temperature of 125 degrees. In series with this hot-water heating system there will be installed a Thatcher hot-water heater using coal and a gas fired heater. On Sundays, the gas from the sludge tank will be diverted from the incinerator to this hot-water boiler. In extreme cold weather the coal heater will be used on Sundays if necessary to prevent excessive losses in the hot-water storage tank and forestall any possibility of freezing in the hot-water system. The hot-water system is divided into three units, each of which has its own circulation pump. The first system includes the storage tank and the three heating elements; the second is a system for heating the sludge tank, and the third is utilized for heating the office and the shop.

### *Sewage Treatment Works*

The sewage treatment works are for primary treatment and consist of settling tanks with two hours detention of average flows, and separate sludge digestion. The digestion tank is to be built of steel throughout and is housed in the main building, where it is readily

*(Continued on page 33)*




*Plan and sections of combined refuse and sewage disposal plant*

# Solving Boulder Dam Problems

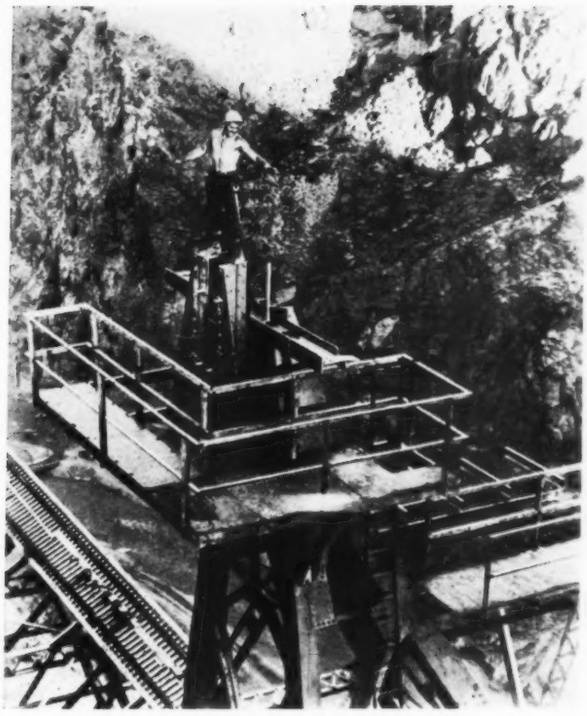
THE Boulder dam furnishes excellent material for Sunday editions and other popular reading, for non-technical readers can understand statements showing it to be the highest and most expensive dam ever built and be impressed by the photographs which so clearly bring out its Brobdingnagian proportions.

But there are scores of features of design and construction, many never before used, which are of special interest to engineers. Most of these were developed to meet special problems originating in the size of the dam, but many of them will probably be adopted for future work of less magnitude.

### *Concrete Temperature*

Perhaps the most important problem was that presented by the unprecedented mass of concrete. The dam contains 3,400,000 cu. yd of concrete, is 729 ft. high from the lowest point, where it is 660 ft. wide. As much as 7,883 cu. yd. has been placed in one day, and 204,000 cu. yd. was placed in one month. Placing concrete began in June of 1933, and to date more than a million yards have been placed. The chemical action of hydration in a large mass of concrete raises the temperature 40° or more above that at which it was placed; and when the concrete cools, stresses are set up, some of which cause cracks. The design of a dam, whether gravity or arch, assumes that the only stresses are those due to gravity and external pressures, and the existence of stresses unforeseeable as to either amount or location would necessitate a large factor of safety, with additional cost.

This problem was met in Boulder dam in three general ways: By using a special cement which produced one third less heat generation than standard cement; by artificially cooling the concrete so as to hasten its attainment of a desired temperature; and by building it as a series of interlocking vertical columns which, when they have cooled and reached their minimum dimensions, are united by filling the joints with grout. There were many minor features, such as the exact proportioning of the concrete, so placing it as to avoid segregation, preparing surfaces of hardened concrete to receive fresh concrete, etc. Each of these could be made the subject of an extensive article. It will be possible to little more than mention some of the most important.



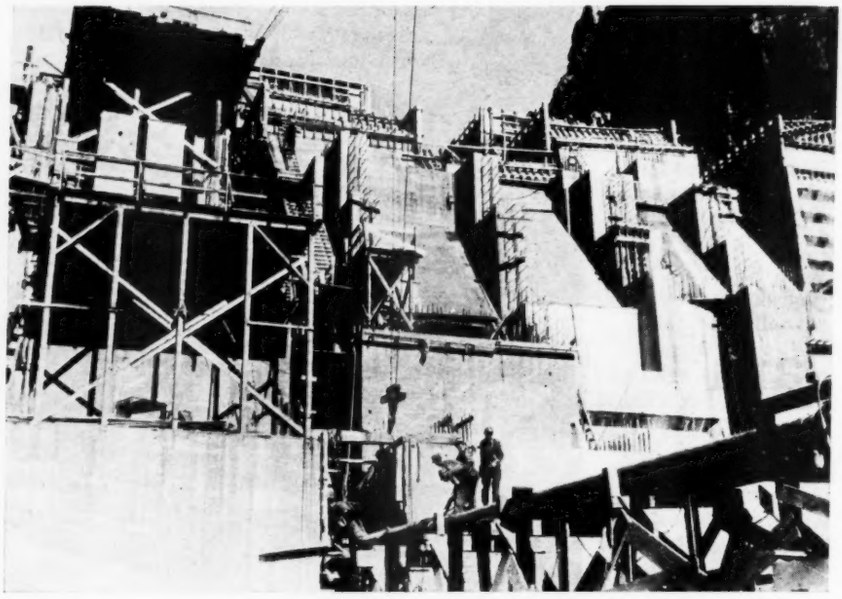
*Top of cableway tower on Nevada rim of Canyon*

*Special Cement and Concrete.* The characteristics of low-heat cement were described in PUBLIC WORKS for December, 1933. This cement is purchased from four mills under rigid specifications, and the four makes blended to secure more perfect uniformity. The proportions used for the concrete are 1 part cement, 0.54 water, 2.45 sand, 1.75 fine gravel, 1.46 intermediate gravel, 1.66 coarse gravel, and 2.18 cobbles up to 9 in. (the maximum size allowed); or 1 part cement to 9.50 of aggregate. The volume of cement paste is only 2% greater than the voids in the dry rodded aggregates. This necessitates thorough mixing and freedom from segregation during placing.

The columns vary in size from 25x30 ft. at the down-stream face of the dam to 50x60 ft. at the up-stream face. Each column is raised 5 ft. at a time, and the top surface of each 5-ft. lift is cleaned to receive the next one by washing with air and water applied together under high pressure as soon as the concrete has taken initial set, with chipping or wire-brushing if necessary to remove laitance.

As the columns contract on cooling, the joints between them open, the columns being of such size that the joints will be wide enough to admit the neat cement grout, for which a minimum of 0.10 in. width is sufficient, the cement being screened through a 200-mesh screen just before use. The grout is applied through a system of pipes buried in the concrete, with outlets distributed over the faces of all joints so that there is an outlet for each 30 to 50 square feet.

*Cooling the Concrete.* It is assumed that the temperature at the base of the up-stream face of the dam, when water is in the reservoir, will be about 40°F. and of the down-stream face 75°, and the aim is to produce these temperatures in the concrete, varying uniformly through the dam from one to the other, before grouting the joints. This is effected by inserting throughout the concrete, during construction, a system of 1 inch pipes



*Laying 14-inch pipe lines to carry refrigerated water for cooling the concrete. Shows the 8-foot slot in which are installed the 6-inch cooling system header pipes and control valves.*

through which water is pumped. Air-cooled water is used at first, followed by water refrigerated to 40°F. Resistance thermometers are distributed at intervals throughout the dam, to determine when the desired temperature has been reached, checked by closing off sections of the piping system full of water and taking the temperature of this water after 48 hours.

A vertical slot 8 ft. wide is left in the center of the dam normal to the face, and in this are laid 6 in. horizontal pipe lines, two at each 10-ft. level, one to supply the cooling water, the other for return water. These are connected to two 14 in. mains, and in turn feed the 1-in. pipes spaced 5 ft. apart vertically and 5 ft. 9 in. horizontally. Each 1-in. pipe runs in a loop from a 6-in. header to the end of the dam (a maximum distance of 1160 ft.) and back to the return header. There are about 300 miles of these cooling pipes. The 6 in. and 14 in. pipes are insulated with a 2-in. cork covering.

Cooling is carried on in 50 ft. stages. From a point 35 to 50 ft. below the level under construction, for a depth of 50 ft., air-cooled water is circulated, while in the next 50 ft. stage, where air-cooled water already has been circulated, refrigerated water is circulated. As soon as a stage has been reduced to the desired temperature, the joints are grouted and the 8 ft. slot filled with concrete up to its upper level. The first cooling with refrigerated water began Oct. 11, 1933. The refrigerating plant consists of three 275-ton compressors, and can remove 220 B.t.u. per minute.

In addition to thermometers, strain meters are distributed throughout the concrete to determine deformations during the setting, cooling, etc.; and joint meters at the joints indicate how wide these open as the concrete contracts.

*Spillway Concrete.* The two spillways are side channels excavated in solid rock, each 700 ft. long, 40 ft. wide on the bottom, 75 to 128 ft. deep, and with side slopes of ½ to 1. The reinforced concrete lining of these slopes was built in panels 14 by 15 ft. and 24 in. to 18 in. thick, anchored to the rock by 1⅛ in. steel bars set and grouted in holes at least 5 ft. deep; the outer ends of the bars being hooked, and the reinforcement fastened to them. A 3 in. porous concrete tile runs down the slope beneath each panel joint and connects at the bottom with a 2½ by 5 ft. drain running down the center of the spillway channel These tile drains are made of concrete mixed one part cement to six aggregate, mixed very dry; and the entire bottom of the channel is lined with 12 in. thickness of the same porous concrete.

### *Welded Penstocks*

Fabricating 45,000 tons of steel plates of up to 2¾ in. thickness into penstock pipe from 8½ to 30 ft. in diameter is another notable feature. The largest pipes are built of 32 ft. by 12 ft. plates, three plates making a ring 96 ft. in circumference and two rings being united to form a unit 24 ft. long which weighs about 150 tons. All seams are electric welded. The most powerful plate-bending roll ever made is used to bend the plates, and is capable of exerting a pressure of 3,500,000 lbs. The edges of the plates are planed to form a welding V-groove. The welding arc is stationary and the pipe is turned slowly or moved longitudinally to move the seam past the arc while welding. As soon as a joint has been completed, the entire weld is X-rayed in 30-in. lengths, a total of more than 400,000 lineal feet of weld; using two 300,000-volt X-ray machines. If any flaw in the weld is discovered it is chipped out and rewelded. The pipe is then annealed at a temperature of 1200° to relieve any stresses, held at this temperature for a time and cooled slowly during three hours to 600°. Hot gases from oil burners circulate through the welding furnace and pipe, reversing direction at intervals of a few minutes to secure uniformity of temperature; the temperature being maintained automatically within 20° of that desired.

After being cleaned by shot blast, the pipe is given a prime coat of water-gas tar, followed by a coat of hot coal-gas tar. The pipe sections are then taken to the edge of the canyon and lowered by a 150-ton cableway to the ends of the tunnels, into which they are carried to their final location in the tunnels and joined to those already in place.

---

## Highway Beautification by CWA

Detailed procedure plans for highway beautification financed by CWA funds have been sent to division engineers of the Ohio highway department by Charles McKee, chief engineer of maintenance who is in charge of CWA highway work.

The state highway department will have final approval of any projects selected for CWA. In order to employ as many men as possible on the 30-hour week schedule, two shifts of CWA men are used, from 7 to 12 and 12 to 5, six days a week.

*Low place in concrete pavement being raised to grade by mud jacking*

# Soil Materials Suitable for Mud Jacking

MUD jacking, introduced into the procedure of concrete pavement maintenance not so very many months ago, has become the recognized method of raising sunken pavement slabs. As such, it has been studied by the Bureau of Public Roads, or at least the earth or other materials suitable for use have been so studied. The result of these studies has been reported by A. M. Wintermyer, assistant highway engineer, Division of Tests of the Bureau, and the more important of the conclusions are abstracted below.

The study included (a) "Analysis to determine what is to be required of the material for the use intended. (b) Determination of the dominating characteristics satisfying these requirements. (c) Selection of the particular tests best suited to furnish the desired information on these dominating characteristics."

Under (a), "A satisfactory mixture of soil, portland cement and water for use in raising settled areas of road surfaces by mud jacking must be of such a character that it can be readily forced through the mud jack. It must possess qualities which will enable it to spread freely over the subgrade as the separation between the road surface and subgrade increases during the pumping operation, and it must prevent appreciable settlement of the raised area of pavement after the pumping operation. . . .

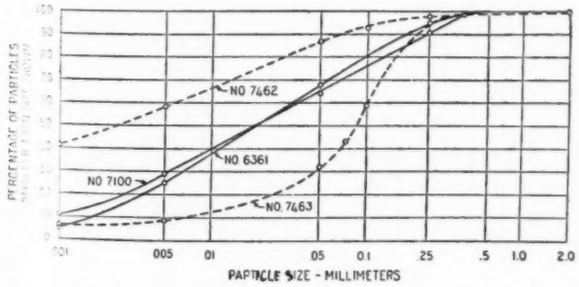



FIG. 1. *Results of mechanical analyses of four samples of soil*

"The essential qualifications of a mixture for use in mud jacking can be stated as follows: 1. The paste should be fluid enough to be readily pumped. 2. It should be free enough from harshness to spread to the desired extent over the subgrade. 3. The paste, even in the high state of fluidity required for satisfactory performance in the pump, must not be subject to detrimental shrinkage upon loss of moisture. 4. The paste, after being properly placed, must change rapidly from a highly fluid, smooth-flowing state to one which is stable enough to resist lateral flow under considerable pressure."

No. 1 is furnished by the finer soil particles—silt and clay. Harshness is furnished by sand; generally the larger the sand particles or the higher the sand content, the harsher will be the soil paste. Sand, however, increases the stability of the mixture and decreases shrinkage; but a mixture containing all the sand desirable for this purpose could not be forced through the pump and hose. Rapid increase in stability and elimination of detrimental shrinkage can be obtained by adding a sufficient amount of portland cement. (Probably other materials will be found which will serve the same purpose.)

Fine sand (passing a No. 60 sieve) is better than coarse sand. "Soil for use in mud jacking should consist of fine sand, silt, and clay in such proportions that the paste formed from the silt and clay will completely encompass all of the sand particles so as to eliminate detrimental harshness of the mixture. The silt and clay fraction should be free of gluey colloids productive of high water capacity, high plasticity, and excessive shrinkage and, in addition, should be of the inactive character required to form a paste of the desired consistency and smoothness with minimum additions of

water." The report recommends that the selection of the soil be based upon mechanical analysis and determination of shrinkage limit and liquid limit.

The shrinkage limit is defined as the moisture content at which further evaporation does not produce further decrease in the volume of the soil.

The liquid limit is the moisture content at which a groove (see Fig. 3) separating two parts of a divided soil cake is just closed by ten shocks.

The ratio of the shrinkage limit to the liquid limit indicates the shrinkage properties of the soil. The smaller the shrinkage limit as compared with the liquid limit the greater will be the tendency for the soil to shrink and consequently the greater will be the amount of cement required to prevent the shrinkage from becoming objectionable.

Table 1 shows the results of laboratory tests on four soils, two of which were suitable and two not suitable. S-7100 worked well in the pump, but S-7462 has a high clay content and could not be formed into a smooth paste, and jammed in the pump. S-7463 has a high sand content and formed a mixture so harsh that it "packed" both in the pump and under the pavement.

TABLE 1.—*Results of laboratory tests on soils used in mud jacking.*

| Sample No. | Mechanical analysis, percentage by weight: Passing No. 40 sieve | Coarse sand—2 to 0.25 mm | Fine sand—0.25 to 0.05 mm | Silt—0.05 to 0.005 mm | Clay—smaller than 0.005 mm | Liquid limit | Shrinkage limit |
|---|---|---|---|---|---|---|---|
| S-6361 ... | 99 | 5 | 27 | 43 | 25 | 26 | 21 |
| S-7100 ... | 98 | 9 | 27 | 35 | 29 | 33 | 15 |
| S-7462 ... | 99 | 3 | 10 | 29 | 58 | 72 | 9 |
| S-7463 ... | 99 | 5 | 63 | 24 | 8 | 16 | (1) |

[1] Pat did not shrink in test.

The soil represented by S-6361 seems particularly well suited for mud jacking and its essential characteristics may serve as a guide in studies of soils for this purpose. This soil is representative of well graded and thoroughly weathered topsoils with little or no material retained on the No. 40 sieve. It is stable in road surfaces in both wet and dry weather but erodes badly in cut or fill faces. The fine sand (27 per cent) furnishes stability without producing harshness of mix. The clay (25 per cent), is relatively inactive. This is disclosed by the low liquid limit of 26 as compared with

FIG. 2. *Equipment for determining "liquid limit" of soil*

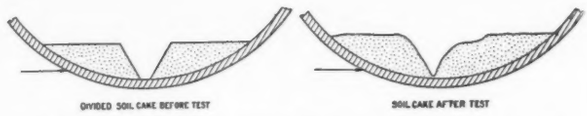



FIG. 3. *Soil cake before and after groove is closed by jarring*

a typical liquid limit of about 36 for average soils containing 25 per cent of clay.

Shrinkage limits equal to or greater than about 75 per cent of the liquid limits are indicative of inactive soils in which shrinkage is not important.

The moisture content required to furnish the necessary fluidity of this soil, as determined by trial in the mud-jack operations, was found to be about 40 per cent without cement admixture and about 42 per cent with the cement admixture.

The shrinkage limit was raised above 21 by cement admixtures. When the cement was 1% of the weight of the soil the shrinkage limit rose to 29; at 3% it was 31; at 5% it was 38; and with 7% no shrinkage of the pat occurred.

In this test of S-6361, 42% of moisture was used, but in service, contents varying from 40 to 46% appeared to work equally well.

"In some cases it may be impractical to add enough cement to the soils which must be used, to completely eliminate all possibility of shrinkage. However, a conception of the basic physical requirements of pastes for use in mud jacking and a knowledge of the simple laboratory tests for disclosing the properties of soils and soil mixtures will assist materially in the selection of the best soils at hand.

"A laboratory investigation of this character should include the following steps:

"1. Hydrometer method of analysis to determine the grading.

"2. Determination of the flow curve of the soil without admixture to furnish the liquid limit and give some idea of the moisture content at the desired consistency of mix.

"3. Determination of the shrinkage limit corresponding to several admixtures of cement to determine the effect of cement in reducing the shrinkage of the mix on loss of moisture.

"It is safe to assume that all soils which the suggested laboratory tests show to have the same characteristics as soil S-6361 are physically the same and therefore should duplicate the good performance of this soil in mud jacking. We are not in a position, however, to say how far the characteristics of soils may vary from those of S-6361 and still be suitable for mud jacking."

## Full Moon for Leakage Tests

Detecting water leakage is a regular scheduled function of the Danvers, Mass., water department. The town is, for this purpose, divided into six districts, each of which is tested once a year. Said Sup't Esty: "We always do it during a certain month, as monthly consumptions are generally comparative. We wait for a full moon, as it is more pleasant to work on a moonlight night, and it provides sufficient light to do most of the work without special lighting facilities. We always hope for a rain preceding this test, as the cooler atmosphere that generally follows curtails household and irrigation usage and practically eliminates the use of the hose." The leakage is measured by a meter in a line of hose connecting two fire hydrants.

*Main building*
*Shades Valley Plant*

# Planning and Financing Sewage Treatment In Birmingham

THE recently completed sewage treatment plant at Ensley (Birmingham), Ala., has aroused much interest, which is justified because of the very low initial cost—something like $1.35 per capita—and a correspondingly low operating cost. These low costs have been obtained by good design, by use of the latest equipment, and by providing for only immediate needs in degree of treatment, while allowing for adequate extensions in this when and if they should be necessary.

But while the Ensley plant is interesting, of itself, it is but one unit in a larger plan which includes the construction, operation and financial management of six more or less related projects designed to give adequate treatment to the sewage of Birmingham and its suburbs, totalling at present in excess of 36 million gallons a day. The population of this district is now about 362,000, and these projects are designed to care for an estimated total population in 1947 of approximately 500,000. The total cost of the entire plan is about $600,000.

To conceive, plan, design and coordinate the construction of this sextuple project, and fit the costs of construction, operation, interest and amortization together, so that the available income would always cover the total expenditures, required engineering skill of the highest order. This article describes briefly how this was done. The accompanying chart shows graphically the total income anticipated for each year, the date of beginning the construction of each of the six projects, the date of completion of each, and the total costs at all times for construction, operation, interest and amortization.

### *The Problem at Birmingham*

There are four principal drainage areas in the Birmingham district. The city itself is drained by two creeks—Valley and Village. To the south is Shades Valley, probably the finest residential area in the south. To the north is the Five-Mile Creek drainage district.

The trunk sewers in the Valley and Village Creek sections were built some thirty years ago, and at that time two treatment plants were constructed, which have long since ceased to function. No trunk sewers have been available in the other areas, and the residents therein have generally been obliged to rely on small septic tanks and other substitutes.

The plants serving these four areas are described briefly below.

### *Village Creek (Ensley Plant)*

The Village Creek trunk sewer serves a portion of the city having a population of around 130,000, of which about 100,000 are now connected to the sewer; the estimated 1947 population is 160,000. The present dry weather flow is about 9 mgd; the storm flow 18 mgd. The plant is designed for a dry weather flow of 15 mgd.

The plant discharges into Village Creek. Three miles down stream is a very large impounding reservoir of the U. S. Steel Corp., and 12 miles further is the Warrior river; wherefore primary treatment was deemed to be sufficient. A brief description of this plant ap-

*Cast iron pipe laid for sewers in Jefferson County*

peared in PUBLIC WORKS for March, 1933. The total cost was $175,000, or $1.35 per capita, which is remarkably low in view of the very complete equipment with which it is provided. Some cost data on this plant, which appear later in this article, indicate clearly that low unit costs of construction were not solely responsible for the moderate cost.

### *The Valley Creek (Bessemer) Plant*

Valley Creek sewer serves an area having a population of about 180,000, of which 150,000 are connected to the sewers. The estimated 1947 population is 283,000. The present dry weather flow is 14 mgd; the plant is designed to handle a storm flow up to 40 mgd.

Valley Creek, from the outlet of the treatment plant, flows west some 35 miles to the Warrior river, passing through an undeveloped and wild region. As a matter of fact, it is practically an open sewer carrying industrial wastes. There has been some agitation for making this stream a navigable waterway. Consequently, good design indicated the construction of a plant suitable for present day needs, but which would fit into almost any type of plant that the future dictates.

The design for this plant, therefore, provided for a modern screening plant to remove solids from the stream. Bids for this plant were received about a year ago, the low bid being $31,000. The plant consists mainly of the following units:

Mechanically cleaned bar screen
Venturi type sewage meter.
Main building housing screen room, incinerator, office and laboratory.

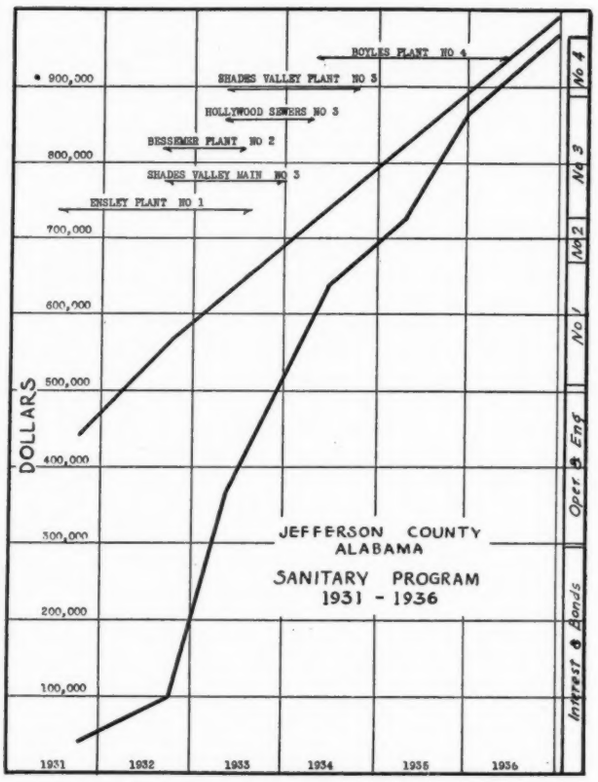
The screen mechanism is a rack screen with ¾" clear openings, cleaned by an electrically operated raking mechanism controlled by a time clock. This delivers screenings into 18-cu. ft. industrial cars. For the present, these screenings are buried, but provision is made for the future installation of an incinerator, for which natural gas is available.

### *Shades Valley Sewer Extensions and Plant*

Trunk sewer construction in Shades Valley was started in 1928, when 1¼ miles of 48-inch main was laid. In December, 1932, this main was extended 3½ miles further up the valley. An unusual feature of this work was the use, on about half of the main, of an especially designed 42-inch cast iron pipe, which cost only 12% more than concrete pipe. By using cast iron pipe in this section, which is very wet, future treatment costs will be materially decreased.

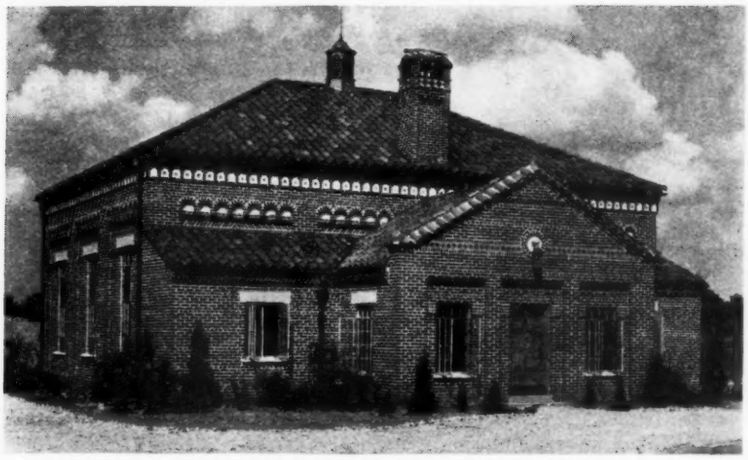
The population in this area is estimated to be 22,000 in 1948, of which 70% will be connected to the sewers. To allow for infiltration, the Shades Valley plant was designed for a flow of 2 mgd. The unusually small dry weather flow in Shades Creek and the extensive recreational use of the stream require a high degree of treatment, at least during certain seasons of the year. To accomplish this, while securing low construction and operating costs and flexibility to provide either primary or complete treatment, chemical treatment was adopted.

Among the factors of importance in this decision were the greatly varying strength and volume of the sewage, the land area required, the possibility of odors




UPPER LINE INDICATED TOTAL INCOME; LOWER LINE, TOTAL EXPENDITURES

*This chart shows the progress of the construction program in connection with income and expenditures. When work on the Ensley was about half finished, the Shades Valley Main and Bessemer Plant were begun and as work on these three neared its conclusion, the Hollywood Sewers and Shades Valley Plant were started. Income is 3c per $100.00 valuation (Valuation on 60% basis).*



*Building, Bessemer Plant with provision for incineration*

and fly nuisance and, of course, the considerable saving in cost over trickling filters. Initial and operating costs in this particular situation and the patent litigation over the activated sludge process were factors in eliminating that process.

The plant consists of a sewage meter, flash mixer, slow mixer or flocculator, 2 settling tanks, 2 digesters, 5 sludge drying beds and a main building housing the screen, chlorine and chemical dosing apparatus, pumps, laboratory and other facilities.

As illustrating the thought given to design, this plant can be operated in six different ways: 1. Plain sedimentation, treating up to 4 mgd; 2. Plain sedimentation and chlorination; 3. Chemical precipitation with settling tanks in parallel; 4. Settling in one clarifier, chlorination and contact in the other clarifier; 5. Settling in one tank, dosage with chlorinated copperas and free chlorine, flocculation and sedimentation in the other clarifier; 6. The admixture of chemical sludge, followed by chemical treatment, flocculation and sedimentation.

An anthracite filter is planned to operate at 4 gallons per square foot per minute to remove the fine floc that will not settle in the secondary clarifier. Sludge from the plant will be digested in two stages, first in a heated tank and then in an unheated tank with floating cover.

The construction cost of the Shades Valley plant is $85,000. In addition, 17,000 feet of 42-inch cast iron sewer was laid at a cost of $122,000, and 7,000 feet of 12 and 24-inch tile sewers at a cost of $32,000, a total for sewer construction of $154,000.

### *The Five Mile Creek (Boyles) Plant*

Studies are now being carried out on this project, which is scheduled for construction in 1936. The present population on this area is now about 15,000 and the dry weather flow is about 2 mgd. A high degree of treatment will be necessary on this project because Five Mile Creek is the source of water supply for Flat Top, about 20 or 25 miles down stream.

### *Some Unit Costs at Ensley*

The construction of the Ensley plant involved 15,000 cubic yards of earth excavation at 23 cents; 5,000 yards of rock excavation at $1.15; 2,700 yards of Class A concrete at $10; 450 cubic yards of Class B concrete at $9.35; 75,000 pounds of cast iron pipe at .032; clarifier mechanism, $24,500; digester, $25,300; detritor, $6,250; bar screen, $2,500; pumps, $2,550; buildings, $10,450; laboratory equipment, $1,600; electrical system, $2,000; dry feed machines, $450; and many other items requisite for the modern plant. These costs are quoted merely that the total cost may be considered from the proper viewpoint. Even landscaping has been provided to set off the plant in proper style, though the total cost was only $300.

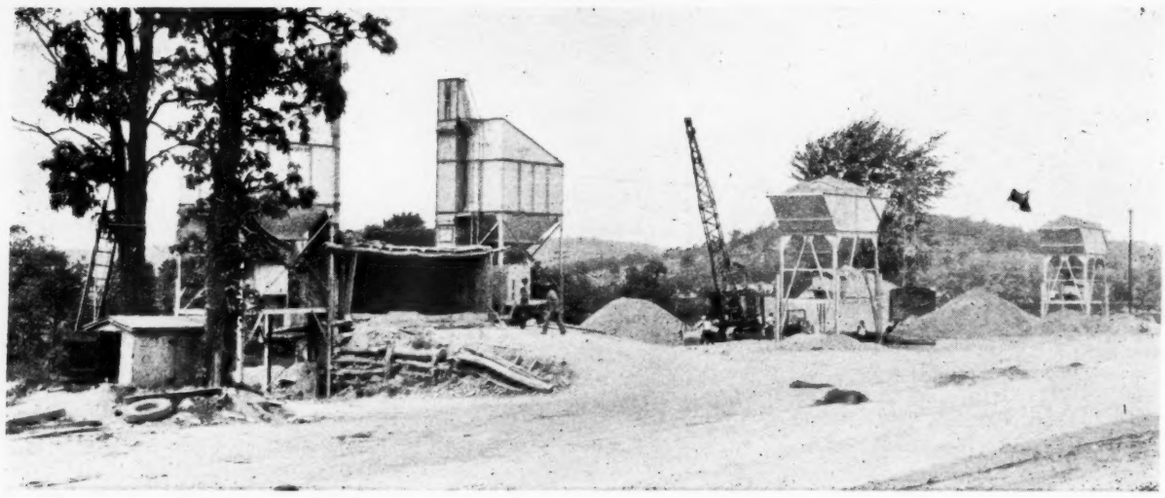
The conception, design and execution of this program have been in the hands of Harry H. Hendon, sanitary engineer of the Commission of Jefferson County. This commission, which has given staunch and sympathetic support to this remarkable and complete program of long-needed sanitary improvements, consists of W. D. Bishop, chairman, R. E. Smith and W. E. Corning. Wellington Donaldson represented Fuller & McClintock, as consulting engineers. A. Clinton Decker, sanitary engineer of the Tennessee Coal, Iron and Railroad Company, collaborated in the work.

Among the many factors of great interest in connection with the entire project have been: The vision and courage of the county commission in proceeding with these improvements despite hard times, which were keenly felt in Birmingham; the very careful planning and forethought evident throughout the design of the project; insistence upon the use of the most modern methods of sewage treatment; the combination of engineering and finance; the care given to appearance in the structures; the general good workmanship throughout; the considerable variation in type of the several plants to adapt each to the conditions it had to meet, and the common sense approach to the whole problem.

## Engineers as Divers

The British Admiralty requires every engineer probationer in the department of the civil engineer-in-chief to attain a reasonable proficiency in diving before his appointment as an assistant civil engineer is confirmed. "The Engineer" (England) believes that such training should be more general, since it is very desirable that the reports of divers on under-water conditions should be made or confirmed by men with a better understanding of engineering problems than the average diver. Commenting on this, "The Canadian Engineer" says:

> Under-water construction is usually difficult and upon the soundness of the work great issues may depend. The supervision of work of similar character above ground is seldom entrusted to men with so little training in construction work as the average diver. There is no great risk involved, probably the engineering student on the football field runs greater risk of physical injury than the diver on ordinary under-water construction. Any young man with sound heart and lungs, and with no defects in hearing, should be capable of going under water after two or three lessons, and training can be undertaken in an ordinary swimming tank.
>
> There can be no question that an engineer who has added diving to his accomplishments possesses an asset which may count much in his favor, and it seems desirable that universities and colleges should make provision for such training; of course following a proper medical examination for the necessary fitness.



*Central aggregate plant. Sand bins at the right. Stone bins and crusher at the left*

# Handling 54,000 Barrels of Cement on a Highway Job

THE planning necessary for economical handling of materials on a large job is well illustrated by the work of constructing 5¾ miles of Eastern State Parkway, a continuation of the Bronx River Parkway. This job is located 15 miles from tidewater or other transportation means, and all materials must be hauled in over poor roads, in the hill country of southern Putnam County. This job, by the way, is under Federal Aid regulations, and the labor is limited to 30 hours per week. In an effort to keep the equipment going a reasonable portion of the time, two shifts are employed, making a 60-hour week for the supervising engineers and the office force. Common labor is largely or entirely from relief rolls.

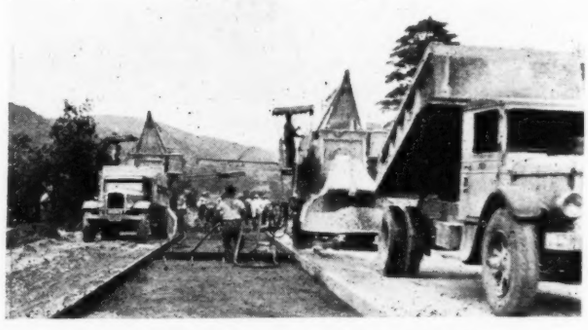
The road is being constructed in four lanes, the two outer ones being 11 feet 6 inches wide and the inner ones 10 feet. The work is being done by the J. W. Williams Engineering Corporation, of New York City, with J. W. Williams in general charge of the work and S. D. Hoffman in charge of material, equipment and direction.

### *Handling Cement*

Cement for the job is furnished by the Lehigh Portland Cement Co. It is shipped in bulk cars (old cars rebuilt with roofs containing 6 to 8 tight doors and the old hoppers replaced with 4 smaller ones) to Hoboken, where it is unloaded by gravity into barges each holding approximately 2500 barrels of bulk cement. These barges are towed to Roa Hook dock, near Peekskill, where it is unloaded into large-body trucks and hauled the 15 miles to the site of the work.

The equipment at Roa Hook consists of a breasting and equipment storage barge, to keep the cement barges away from the dock, and one or more cement barges. Usually while one barge is being unloaded, another is kept at hand loaded or en route from Hoboken.

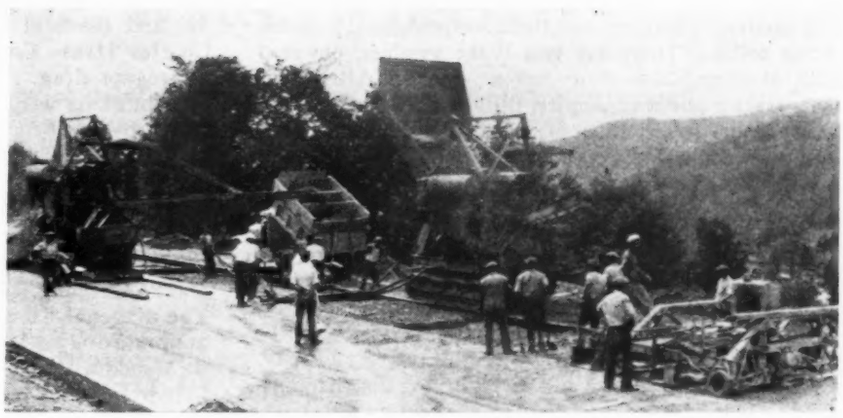
Unloading is accomplished by means of two Fuller-Kinyon cement pumps, one of which has a capacity of 90 barrels an hour and the other one a capacity of 150 barrels per hour. A 50-hp Westinghouse motor operates a Fuller-Kinyon air compressor; and a 40 hp squirrel cage motor operates the cement unloaders. This is all 3-phase, 60-cycle, 220-volt equipment. The unloaders deliver the bulk cement through 120 feet of 4-inch flexible rubber transport line, which carries it across the barges and connects with a 4-inch iron transport line, through which it is discharged into a Butler cement bin against an elevation of about 40 feet. The bin has a capacity of 300 barrels. When it is filled, a horn blows automatically, as a warning for the engineer to shut off the compressor. The maximum day saw 31 truck loads of cement, each of 42½ barrels, taken out of this plant. Average daily deliveries are around 900 barrels. Only the larger of the two unloaders ordinarily is used. It has been equipped with rubber tired wheels in place of the rough-treaded wheels which roughened the wooden flooring of the cement barges.



*Two mixers laying one of the four lanes*

The job of smooth transportation and delivery of the cement to the bin at the dock is in charge of Major

Harry A. Hall of the Lehigh Portland Cement Co. There is a considerable saving to the contractor in the use of bulk cement, even under the rather adverse conditions existing on this job.



*Two mixers are used, one for base, the other for top course*

### *On to the Job*

The bulk cement trucks (shown at the unloading plant at Roa Hook) dump into twin bins at the site of the work. The cement is elevated by a Chain Belt conveyor into a pair of Butler bins, each of 350 barrels capacity, which are equipped with Butler batching devices.

Sand is hauled from the river at Peekskill, also some 15 miles away, and dumped into stock piles, from which it is loaded into a pair of Butler bins. Stone is brought from a quarry near the north end of the job. The quarry and crushing plant equipment includes a Buchanan 36″ x 54″ jaw crusher, 2 Traylor 12-inch gyratory bulldog crushers, a Gifford-Wood bucket elevator, a Niagara screen, and Ingersoll-Rand air compressors. Stone, as it is hauled to the job, also is placed in stock piles, from which it is loaded, like the sand, into the Butler bins. For handling sand and stone into the bins there are one Northwest and one Byers cranes, both gasoline driven and each equipped with 1¼-yard clamshell buckets.

About 50 trucks are employed, hauling cement, sand and stone, and as batch trucks, carrying three batches to the mixers. These trucks are principally Internationals, Macks and Brockways, of 3, 3½ and 5 tons capacity.

### *Mixing and Placing*

Two paving mixers are employed, in accordance with the terms of the contract, both of them being Foote 27E. As a general rule, one of the mixers puts in the bottom course and the following one places the top course (the material above the reinforcement) and finishes. Since the rear mixer has somewhat less to do, with this arrangement, the front mixer sometimes skips short stretches completely, leaving these to be filled in by the rear machine.

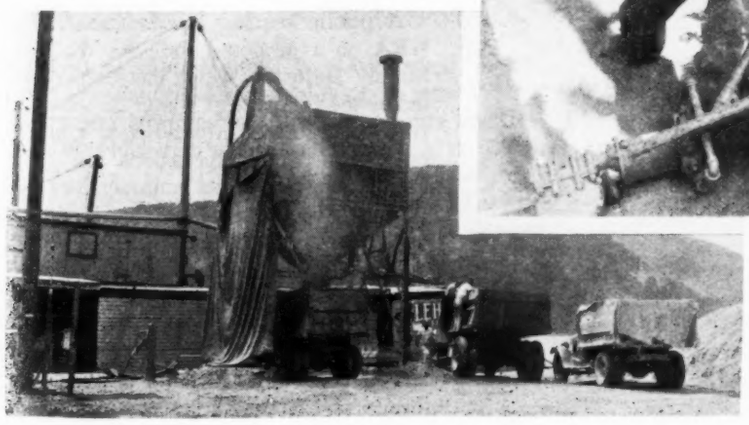
This method of procedure has been found generally preferable to either tandem operation, or to separate operation at distant points. It is not felt that the first method is really economical, at least under the conditions of this contract, while the second method would require two separate and complete organizations throughout. By using the mixers as they are used on this job, a smaller fleet of trucks can deliver the aggregate, and there is much less lost time due to truck delays at the mixer. It is believed that practically the same amount of work can be done with three or four less batch trucks, since the same trucks serve both mixers.

The best day's work with the organization described above has been 2800 feet of 11-ft. 6-inch pavement, while the average is about 2400 feet.

When handling bulk cement, there is often some difficulty in determining where it should be placed in the load. On this job, the trucks are first loaded with stone, then with cement, and finally with sand. The haul is so short there is no danger of wet sand causing preliminary set, and the loose cement does not blow off as is the case when it is placed on top of the load.

### *Other Equipment and Methods*

There are 2 Lakewood finishers on the job. About 10,000 feet of forms are in use, principally Blaw-Knox



ABOVE—*Cement pump, unloading barge to cement bin at Roa Hook dock, shown at the left*

and Heltzel. There are two Buffalo-Springfield and one Acme rollers. There are two Wehr graders, powered with McCormick-Deering motors, one 75 Allis-Chalmers tractor and a Champion Bulldozer. For supplying water to the job, 6 miles of 3-inch pipe line have been laid, and one Domestic and one Barnes pump are used for furnishing water.

***Engineering Personnel***

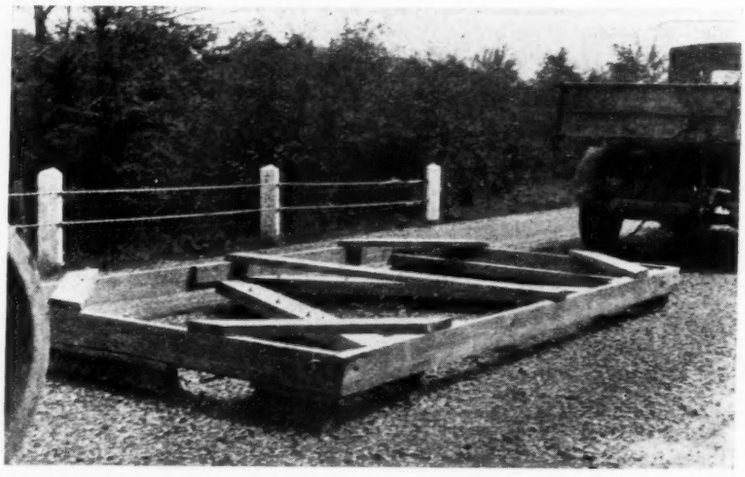
In addition to Mr. Williams and Mr. Hoffman, the personnel engaged on the work include L. Piron, engineer in charge, under Harry Krom, county engineer. These men work under the general supervision of the New York State Division of Highways, Arthur W. Brandt, chief engineer, and J. S. Bixby, district engineer. All landscape and similar work is under supervision of Theodore Bowman, engineer for the Taconic State Park Commission, for which this parkway is being constructed.

# Drags Used in Mixed-in-Place Construction

IN an article on pages 13 and 14 of our September issue we described mixed-in-plate road construction in Sullivan County, N. Y., in which work an aggregate drag and a broom drag played a prominent part. One of our subscribers asked for further information about these, and this has been given through the courtesy of E. C. Lawton, Assistant Commissioner-Construction, New York Division of Highways. Said he:

The aggregate drag that we used in Sullivan County was a homemade device, but its operation was so successful and the field for its use appearing so large, the Charles Hvass Company decided to manufacture an aggregate drag. The old one gave us trouble on account of its weight, but the one now being manufactured by this company weighs about five thousand pounds and can be hauled with an ordinary Linn tractor. Also, it is now provided with a blade on the back of it which levels up the mixed material after it passes through the channels of the drag itself.

The broom drag was approximately 10 feet wide and 24 feet long. The vertical side pieces were 2″ x 8″. The diagonal flat pieces (quoting from memory) were approximately 3″ x 6″. The longitudinal outside pieces were shod with a thin strip of metal. This was to insure longer life and prevent the latter from being unduly worn when it came in contact with rough shoulders which may have been built up along the side of the retread prior to the construction of the retread. The picture shows quite clearly the brooms which were attached to the lower side of the frame. They were the ordinary rattan hand brooms. We merely dispensed with the use of the handles on these brooms and fastened the brooms themselves on the under side of the frame. They were fastened with bolts which could be removed and new brooms added whenever the old ones were worn out. You will note that there are no brooms along the longitudinal outside members of the broom drag. They are confined entirely to the rear end and to the diagonals shown in the picture.



*The illustration at the right shows the broom drag, an important piece of equipment for spreading smoothly and evenly the aggregate for the seal coat. Below is shown the heavy drag, valuable in getting thorough mixing and almost an essential in mix-in-place work.*

BELOW: *The drag used in mixing aggregate.*

## Code for Water Supply Industry

A public hearing is announced by the NRA on a proposed code for the Water Supply Industry, which has been submitted by the Institute of Water Supply Utilities, Incorporated, intended to apply not only to private corporations but also to "such Federal, State, municipal or other publicly operated plants, enterprises or authorities, engaged in the industry, as specifically obligate themselves to put into effect any or all of the provisions of this Code." The Code Authority would comprise representatives of both privately owned and publicly owned plants, apportioned in proportion to their relative gross revenue.

# The Water Wheel

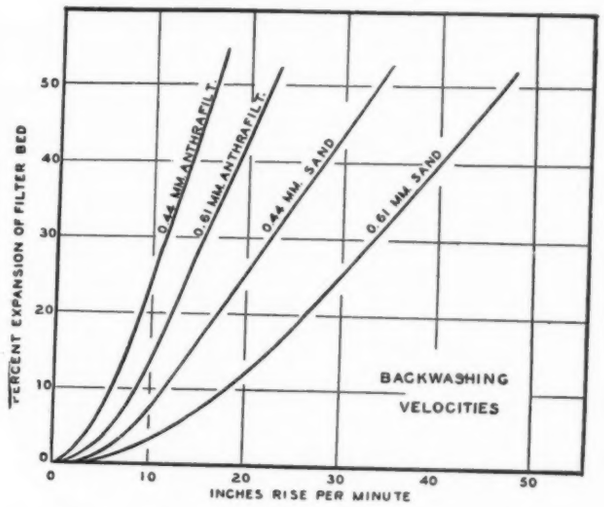
***Following are the essential features of the important articles published last month having to do with water works design, construction and operation and water purification, arranged in easy reference form and condensed and interpreted.***

**FILTER Reconditioning** at Verona, Pa.,[40] where the sand was coated with manganese and iron and mud balls and hard spots persisted, was secured as follows: The filter was soaked for 48 hrs. in water containing 15 to 20 lbs. of chloride of lime per filter (0.5 m.g. capacity). Then a 1″ pipe 8′ long fastened to the end of a fire hose was pushed through the sand to the gravel and raised slowly to the surface, the filter being washed at a low rate meantime. The pipe was applied at intervals all over the bed. "Heavy, dark quantities of manganese, mud, etc., were washed out. With every downward plunge of the pipe a cloud of material seemed to be stirred up and carried away by the wash water." When the entire bed had been washed, the filter washed more easily, hard spots and mud balls decreased and the filter runs were much longer.

**Anthracite Coal Filters** are used in two plants in Pennsylvania—Cumberland and Steelton,[47] in Denver, Colorado, and other places. The Anthracite Institute is studying the matter and hopes to prove such use to be more economical than sand. A special preparation of coal is made which they call "anthrafilt," which is "carefully selected to conform to rigid specifications laid down by us as to toughness, shape of grain, specific gravity and size distribution." This material "possesses a definitely angular shape" and "The initial loss of head for anthrafilt is less than that for the same size of sand, due to the greater percentage of voids in anthrafilt. . . . The backwash velocity required to expand an anthrafilt bed 50% is approximately half the backwash velocity required to expand the same size of sand 50%." To test the loss of filter medium, a filter was washed at 50% expansion continuously for 14 days, and the loss was equivalent to 0.4% a year if the filter be washed every twelve hours for a 5-minute period. Longer filter runs are possible due to greater porosity and less stratification after washing; it is superior to sand in removing bacteria; it is practically insoluble in hot alkaline waters (such as treated boiler water); lime coalings do not adhere to it; it weigh only 55% as much as sand.

**Tar and Asphalt Roads** on a watershed were suspected of causing chlorophenol tastes in some West Virginia water supplies[42] and investigations made, as a result of which it appeared that, when a tar priming coat (1/3 gal. per sq. yd.) was applied "in case of a rain occurring within four hours after pouring of a primer coat, there is considerable danger of contaminating water supplies, particularly close to a water works." With retread material "samples of wash water collected one hour after mixing did not give tastes in 1-20,000 dilution." But priming oils are not used as commonly as they used to be. Asphalt is not believed to be so objectionable as tar.

**Birds Polluted Reservoirs** and tanks in Wilkinsburg, Pa., by their droppings,[29] pigeons in groups of




*Relative expansions of different sizes of sand and anthrafilt with given backwashing velocities.*

5 to 25 and smaller birds in groups well over 100 taking daily baths therein. B. aerogenes and B. coli were found in the droppings, the former predominating in the dried droppings, the latter in fresh ones. These persisted and were found in water drawn from the distribution system. Troy, N. Y., reported similar pollution by gulls, which birds were finally kept from the reservoirs by stringing fine copper wires across the reservoirs in two right-angle directions on 20 ft. centers, the wires being fastened to posts two feet high driven 3 ft. back from the edge of the reservoir.

**A Diesel Engine** replaced a steam pump in the Columbia, Pa., water works plant in January, 1933, and records of the first 8 months' operation showed a saving of approximately 60% in pumping costs[36] over the previous year. Operating high-head and low-head pumps, raising 1100 g.p.m. against 215 ft. and 40.5 ft. respectively with 81% efficiency requires 4.5 to 5 gals. of fuel oil per hour and about 12 gals. of lubricating oil a month.

**The Automatic Pumping Plant** of St. Combs, Scotland,[5] is controlled by a time clock which may be set for any desired period of pumping in three pumping periods per day—normally 4 hrs. pumping and 4 hrs. rest. The 2400 g.p.h. pump is operated by a 5 h.p. crude oil engine. When the time switch closes the engine is started by a dynamotor supplied with power from a 25-volt accumulator; starting without any load, as the clutch between engine and pump does not engage until the engine has reached 90 per cent of normal running speed (600 r.p.m.). The pump starts against a low head, pumping water through a by-pass into the suction tank for one minute, when the by-pass valve closes slowly. This automatic operation has been successful; with a normal working head of 85 ft., the maximum pressure at no time exceeds 100 ft.

**Roofing a Reservoir** of 17.5 acres area was desirable at Geraldton, Australia,[7] where the topography permitted only a shallow one and the evaporation was about 70 in. a year. The roof consists of sheets of "Fibrolite" (made from cement and asbestos fibre) 10 ft. long by 3 ft. 6 in. wide, laid flat with gaps about ½ in. wide between them. These rest on timber beams spaced 5 ft. apart centers, level and 2 ft. above the water, which are supported by timber piles driven into the bed of the reservoir. The sides are screened with similar sheets. This is believed to be the largest single roof in the British Empire.

**Copper Service Pipe** is used by the majority of the 82 water works plants questionnaired by Walter A. Peirce[18] and scattered throughout all the states; 30 using copper exclusively, 29 using also lead, steel or iron; only 4 confining themselves to galvanized steel or iron, 5 using this and lead also, 9 using lead exclusively, 2 brass only, and 3 cement-lined. The price per foot of ¾ in. copper tubing in fifteen cities ranged from 15 to 24.5 cts. in 1929, averaging 18.94 cts.; and in 1933 averaged 12.03 cts., ranging from 8 to 21.5. Most of the managers stated that the cost did not affect their choice, the policy being to "use the best material obtainable, giving consideration to the life of the pipe rather than to its cost," the additional cost being not more than 4 or 5% of the total cost of the service. 56% of the 70 municipal plants own the service and 67% maintain all or part of it.

### *Bibliography of Recent Water Works Literature*

*c*, Indicates construction article; *n*, note or short article; *t*, technical article.

*Engineering News-Record, January 4.*

1. Tunnel Built under Harbor Entrance for Vancouver Water Supply. By E. A. Cleveland, pp. 1-5.
2. Construction Water Supply for Colorado River Aqueduct. By Julian Hinds, pp. 13-16.

*The Surveyor, December 15.*

3. Algal Growths and Water Supply. By J. W. Husband, pp. 555-556.

*December 22*

4. Village Water Supply: Aberdeenshire. p. 582.

*December 29*

5. Practical River Flow Measurement. pp. 603-604.

*January 12*

6. The Testing of a Centrifugal Pump. By D. G. H. Read, pp. 27-29.
7. Roofing Reservoirs in Western Australia. p. 22.

*American City, January.*

8. Results of Improvements in the Neodosha Water Filtration Plant. By Fred K. Vance, pp. 47-48.
9. Protecting a Water Works Intake. By W. H. Vaughn, p. 48.
10. Day Labor in Covington Built Water Works Improvements. pp. 62-64.

*Journal, American Water Works Association, December.*

11. Consumers' Good Will—Its Value and Method of Promotion. By Frank C. Jordan, pp. 1623-1629.
12. Consumers' Complaints and How to Meet Them. By E. F. Dugger, pp. 1630-1635.
13. Delinquent Water Bills in the Depression. By M. F. Hoffman, pp. 1636-1639.
14. Several Small Meters versus One Large Meter for Large Services. By H. L. Monroe, pp. 1640-1641.
15. Measurement of Small Water Flow. By Dale L. Maffitt, pp. 1642-1644.
16. Value of Continuous Pressure Recorders in Chicago. By Justus B. Eddy and William B. Weldon, pp. 1645-1648.
17. Inspection and Control of Sprinkler System and Other Special Connections. By J. Arthur Jensen, pp. 1649-1652.
18. Selection of Service Pipe Material under Present Prices. By Walter A. Peirce, pp. 1653-1656.
19. Control of Sizes of Customers' Services. By W. W. Morehouse, pp. 1657-1658.
20. Centralization or Decentralization in Commercial Activities. By Carl K. Chapin, pp. 1659-1667.
21. The Handling of Storage Yard Supplies and Equipment. By J. S. Dunwoody, pp. 1668-1680.
22. At War with the Depression in the Detroit Water District. By Hal. F. Smith, pp. 1681-1689.
23. State Regulation of Water Rates for Municipal Water Plants. By A. Bliss McCrum, pp. 1690-1697.
24. Commission Regulation of the Issuance and the Accounting Treatment of Security Issues for Water Works Purposes. By David E. Lilienthal, pp. 1698-1710.
25. Tax Exemptions to Municipal Utilities. By Charles J. Tobin, pp. 1711-1715.
26. Pipe Yard Facilities in Chicago. By William Weigel, pp. 1716-1719.
27. A Modern System of Billing and Accounting in the Chicago Bureau of Water. By H. L. Meites, pp. 1720-1727.
28. Symposium on Cement Lined Water Mains. By Leonard P. Wood, T. H. Wiggin, F. R. Berry, D. A. Hefferman, Reeves J. Newsom, J. E. Gibson, W. R. Conard, D. B. Stokes, H. Y. Carson, B. B. Hodgman, R. S. Weston, John R. Baylis, E. L. Chappell, F. E. Hale, Wm. W. Brush and others, pp. 1728-1780.

*Journal, Pennsylvania Water Works Operators' Assn., 1933.*

29. Contamination of Open Reservoirs and Tanks by Birds. By R. B. Adams, pp. 12-13.
30. Plant Operation at Danville State Hospital. By S. C. Bailey, pp. 13-15.
31. Springdale Filter Plant Problems. By M. D. Baker, pp. 15-16.
32. Leakage Survey. By James Fergus, p. 17.
33. Taste Removal by Pre-Chlorination. By R. W. Haywood, Jr., pp. 18-19.
34. Safe Harbor Water Filtration Plant. By P. M. Hess, pp. 19-23.
35. Use of pH in Handling a Complaint. By Gordon Jenkins, pp. 23-24.
36. Economic Change in a Pumping Station. By Ted H. Kain, pp. 25-26.
37. Lactose Broth Fermenters. By Chas. R. Keattey, pp. 26-27.
38. Changes in Uniced Bacterial Samples During Shipment. By Gilbert L. Kelso, pp. 27-29.
39. Lime Treatment at Greensburg, Pa. By Oscar A. Newquist, pp. 29-31.
40. Reconditioning Filters. By Max U. Priester, pp. 31-33.
41. Algae. By George R. Taylor, pp. 34-40.
42. Road Oils and Tars and Their Effect on Water Supplies. By Martin E. Flentje, pp. 41-42. By Lewis V. Carpenter and Earl W. Klinger, pp. 43-46.
43. Service of the Laboratory to the Water Purification Plant. By Harry E. Jordan, pp. 47-55.
44. Coagulation. By Marsden C. Smith, pp. 56-63.
45. Filter Operating Experiences. By L. E. Wickersham, pp. 64-71.
46. Construction and Protection of Drilled Wells. By A. G. Fielder, pp. 72-82.
47. Application of Fine Anthracite to Water Purification. By H. G. Turner and G. S. Scott, pp. 83-90.

*Water Works Engineering, December 27*

48. Copper Sulphate Treatment. By J. K. Marquis, pp. 1284-1285.
49. Fort Wayne's New Water Plant. By R. L. McNamee, pp. 1286-1288.
50. Influence of Colloidal Chemistry on Treatment of Water. By A. M. Buswell, pp. 1289-1291.
51. Modernizing the Billing and Accounting Methods at Chicago. By H. L. Meites, pp. 1304, 1306.

*January 10*

52. Effect of Earthquake on Water Works. By C. P. Harnish, pp. 12-13.
53. Soap Usage and Water Hardness. By H. W. Hudson, pp. 14-17.
54. Measuring Porosity of Sand. By Roberts Hulbert and Douglas Feben, pp. 18-19.
55. Cost of Operating Diesel Engines. By G. N. Somerville, pp. 33-34.
56. Modern Billing Systems and Collection of Delinquent Bills. By M. F. Hoffman, pp. 34, 36.
57. Service Pipe Maintenance in a New England Water System. By Michael J. Herlihy, pp. 37-38.
58. Complaints of Consumers and How to Handle Them. By B. W. Phillips, pp. 38, 41.

*Water Works and Sewerage, January*

59. Progress in American Water Supply and Purification Practices During 1933. By H. E. Jordan, pp. 1-6.
60. Wayside Water Treatment on the Lehigh Valley Railroad. By J. V. Cardillo, pp. 11-14.
61. The 20th Anniversary of Completion of Los Angeles Aqueduct, pp. 21-22.
62. Tastes, Chlorine and Chloramines in Water Purification. By Chas. H. Capen, pp. 31-33.
63. Locking Device for Curb Boxes. B. E. T. Cranch, p. 34.

*Canadian Engineer, January 2.*

64. *c.* Clear-Water Tunnel for New Toronto Duplicate Water Supply, pp. 7-10.
65. Maintenance of Gate Valves in Water Distribution System. By G. H. Finneran, pp. 11-14.

*January 16*

66. Cementation of Abitibi Dam Foundations. By M. Taylor, pp. 5-6, 12.

*Public Works, January.*

67. Metering Water Would Save Philadelphia $180,000 a Year. 16.
68. Chemicals Used by Canadian Water Works. p. 22.
69. R. F. C. Funds for Improving Private Water Plant, p. 22.
70. Financial History of Quincy, Ill., Water Works, pp. 23-24.
71. The Water Wheel, pp. 31-32.
72. Large Welded Pipe Line for Los Angeles. p. 35.
73. Water Purification in South Africa Compared with American Practice, pp. 35-36.
74. Taste and Odor Control by Activated Carbon. p. 36.

*Proceedings, American Society of Civil Engineers, January.*

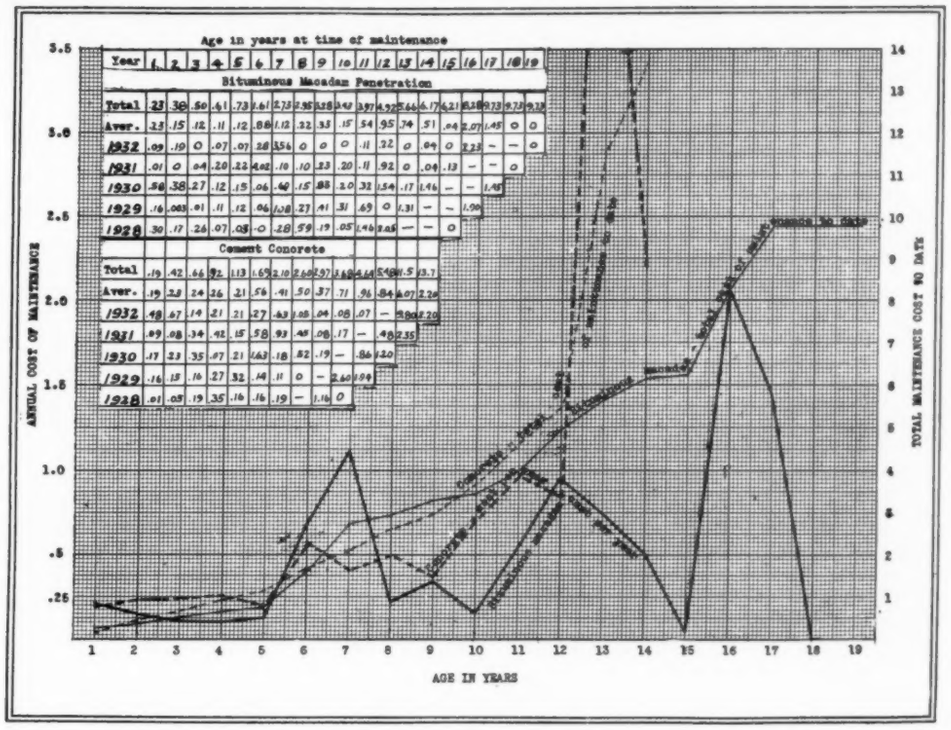
75. Stability of Straight Concrete Gravity Dams. Discussion by W. P. Creager, F. W. Hanna, L. R. Jorgensen, I. M. Nelidov, pp. 112-124.

*Earth Mover, January.*

76. Boulder Dam after Three Very Intensive Years, pp. 5-13.
77. *c.* Gigantic Concrete Wedge, Called Boulder Dam. pp. 13-16.

*Civil Engineering, January.*

78. Drawdown Capacity Curves for Water Wells. By H. C. Schwalen, pp. 10-11.




*Average cost, in cents, of maintenance of all pavements of each age-year, the averages of these for the five years of maintenance; and the total cost to date of pavements of each age, on the basis of these averages.*

# Road Maintenance Costs in Rhode Island

THE Board of Public Roads of Rhode Island had in service and under maintenance in 1932 (the last year whose records are yet available) 2,688,280 sq. yd. of bituminous macadam (penetration) and 2,029,435 sq. yd. of cement concrete; with 1,568,538 additional of bituminous concrete, bituminous surface on concrete base, and amiesite on crushed stone base.

The oldest bituminous macadam road now in service was laid in 1913; the oldest cement concrete in 1918. No roads of the former type were built in 1914 or 1915, and no cement concrete in 1920; but with these exceptions, some yardage of each type has been laid every year since the dates mentioned.

The State Board reports that its "regular maintenance work consists in patching the metalled surface of bituminous roads; patching and oiling water-bound roads; repairing cuts made by utility companies; refilling joints and cracks in concrete pavements; patching, planing and oiling gravel roads; reshaping and oiling shoulders, gutter and ditch work, and repairs to guard rails and drainage structures." The annual reports give the cost of maintenance of each piece of pavement, there being 114 of these built of bituminous macadam and 48 of cement concrete.

With an idea of learning what effect age of pavement had on cost of maintenance, all jobs of each type were segregated by age for each of the past five years, and the average cost of maintaining each age-group determined for each maintenance year. (A pavement built in 1920, for example, would be in the 8-year group in 1928 and in the 9-year group in 1929.) The results are shown in the table and plotted on the diagram, figures being cost in cents per square yard.

These show that, after more or less surface finishing the year after construction, the bituminous pavement cost about 0.12 cents per sq. yd. until the sixth or seventh year, when about 1 ct. is spent; then the cost drops until the eleventh to fourteenth year, when 0.5 ct. to 1.0 ct. is spent. By the sixteenth or seventeenth year more or less repair is needed and 1.5 to 2.0 ct. is spent. During the last two years no maintenance work was done on pavements laid in 1913, on which an average of 1.67 ct. had been spent in 1929 and 1930.

The first line in the tabulation gives the total maintenance cost to date of all pavements of each year-group. Those 19 years old have received, during the nineteen years, a total of 9.73 ct. of maintenance work per sq. yd; those ten years old have received an average of 3.43 cts., etc. The average cost per year of life has been: One year, .23 ct.; two years, .19 ct.; three, .17 ct.; four, .15 ct.; five, .14 ct.; six, .27 ct.; and nineteen years, .51 ct.

As a comparison, similar pavements in Massachusetts have cost, per square yard per year of life: Two years, .04 ct.; three years, .17 ct.; ten, .27 ct. Maintenance in Massachusetts, however, does not include several items covered by the Rhode Island figures, such as gutter and ditch work and repairing guard rails.

Examining the figures for cement concrete pavements, we find the maintenance costs much more uniform, rising gradually from .19 ct. for the first year to .56 ct. for the sixth; then dropping to .37 ct. for the ninth and rising to .96 ct. for the eleventh. The pavements eleven years old in 1931 and 1932 needed repair averaging 6.07 cts. per sq. yd. Probably these, which were the first ones built in the state (in 1818 and 1819) were not so well built as the later ones.

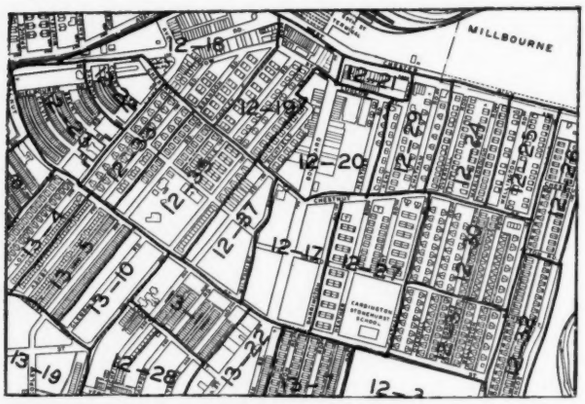
The average cost per year of life of each year-group was: One year, .19 ct.; two, .21 ct.; three, .22 ct.; four,

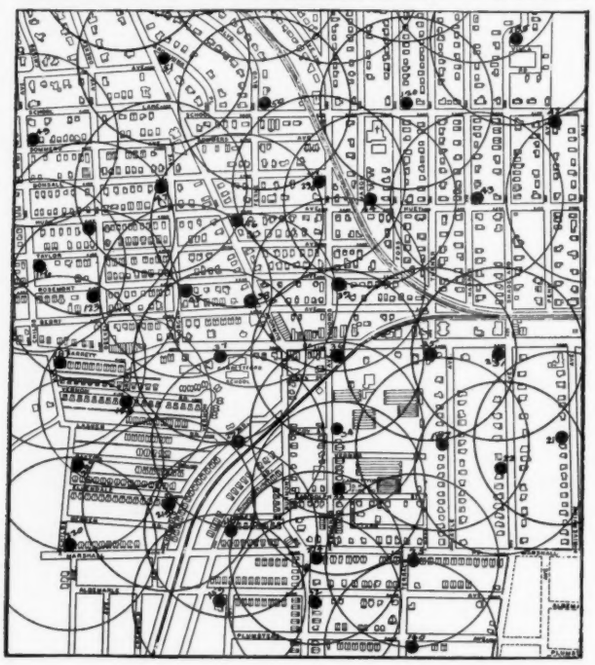
*(Continued on page 26)*

# Key-Maps and Master Plan for a City Engineering Office

By William W. Reeder

THE offices of too many municipal engineers seem to be in a condition of permanent disorder, with dusty rolls of blue-prints, dog-eared field books, broken tapes and unfiled correspondence littered over desk, drawing table and floor. Their occupants seem to feel that it is a sign of weakness to keep any semblance of order, and will probably take pride in telling you that they know just where to lay their hands on any article in the jumbled collection. However, efficient administration is the result of methodical, systematic action, both mental and physical, and disciplined action is difficult in such disordered surroundings. All engineering information in the possession of an office should be available at a moment's notice, and the following suggestions are made with this object in view.



ABOVE—*Sewer lateral key plan.*
BELOW—*Map showing fire hydrants, with 600 ft. circle around each.*

Of primary importance is an adequate filing system, the first part of which consists of giving to each drawing a number to designate the drawer in which filed, and a sheet number. For example: "29-45" locates the drawing as being the forty-fifth in drawer number twenty-nine. Drawings are divided by topics and assigned to different drawers; some classes being so large as to require several drawers.

Where the number of drawings is large, considerable time will be lost looking through a drawer for a particular one, so a card-index system is desirable. This is prepared by listing the drawings alphabetically under the various classes. These classes will include such titles as:—Sewer Lateral Locations; Sanitary Sewers; Storm Sewers; Bridges & Culverts; Approved Development Plans; Right-of-Way; Highways, Etc.

The adoption of standard sizes for tracings will be an aid to the filing system. Small drawings will not be lost among the larger ones, and tracing cloth can be cut without waste. It may also be possible to obtain sheets already cut and printed with border lines and standard titles, thus saving the draughtsman's time in doing this work.

Supplementing the card-index and filing system, and making information instantly visible, should be the function of key-maps and master plans. While the preparation of a master plan is a tedious and costly operation, the results will justify the time and effort. The master plan recently completed under the writer's direction depicted an area of nine and one-half square miles. Drawn to a 200′ scale, this plan was made in two sections, each 4′6″ x 11′. All highways, street railways, buildings, and other physical features are shown, with the house numbers indicated for each block. This plan was adopted by ordinance as the official Township Map, as authorized by Section No. 3203 of the 1931 Pennsylvania Act No. 331.

The plan is also available for platting proposed locations for any new public buildings, civic center, park, playground, or any other public ground or improvement. The proposed widening, extension, or relocation of any public highway may also be shown.

The two sheets of the plan were combined and reduced to a 600′ scale, and maps 32″ x 43″ were printed by the photolithic process at a cost of $74 per thousand. These sell readily to business houses and the utility companies at one dollar each, and in time will pay the cost of preparing the plan.

Blue-line prints were made of the two 200′ scale sections, mounted on linen, and attached to spring rollers. Upon one set of these has been platted all sanitary sewers, showing pipe sizes, gradients, manhole depths, and direction of flow. Another set shows the storm sewers, with all inlets, manhole depths, and pipe sizes. The rollers are hung on the draughting room wall and all sewer information is thus immediately available.

A number of the 600′ scale maps have also been mounted and placed upon rollers. These are used as

*(Continued on page 40)*

*A Digest of the Sewerage Literature of the Month giving the main features of all the important articles published during January*

# The Digestion Tank

**ENGLISH Sewerage Practices** are apparently[5] inferior to those of the United States in many respects. It is common practice, when a sewer changes to a larger size, to raise the crown rather than drop the invert; and small branch sewers enter large mains at the same invert grade, causing a surcharging of the former. Manhole bottoms are poorly designed; manholes few and far between; lamp-holes, abandoned years ago in this country, are still a regular feature. The Ministry of Health requires all sewers with more than 20 ft. cover and less than 4 ft. to be encased in concrete, even reinforced concrete ones. The rational system of calculating storm sewers (described in "Sewerage" in 1890 and in common use in this country for 20 or 30 years) was "introduced to English engineers in 1906; but . . . did not become generally appreciated in England until the republication of Major Roseveare's thesis in 1930."

**Effect of Sewage on Cast-Iron** venturi meters at Baltimore, Md.,[12] in service from 22 to 12 years, was nil. They were found to be "perfectly clean and smooth on the inside. . . . The surface of the iron was covered with a thin, black film." (They had been painted with coal-tar varnish before being installed.) The bronze throat linings were still of the exact diameters originally furnished. The sewage was domestic only, practically devoid of oxygen. The inlet velocities varied from 2 to 8 feet per second, and throat velocities from 8 to 32 feet. "There is no assurance that similar conditions would have been found if the sewage had only partly filled the pipes and the iron surface had been alternately wet and dry."

**Sewage Treatment Costs** of 30 representative plants in Illinois were studied by the State Dept. of Public Health, these including 5 activated sludge, 17 sprinkling filter and 8 sand filter plants, and the information tabulated under 37 items[9]. The installation costs per capita of design population varied, for activated sludge, from $7.05 to $16.95; for sprinkling filters (with Imhoff tanks or sludge digestion) from $9.83 to $34.63; and for sand filter plants (including tank treatment) from $12.30 to $36.30.

The operating costs of activated sludge treatment per m.g. yearly (based on actual amounts treated) were from $16.25 to $27.01, average $24.00; of sprinkling filters (sewage not pumped) from $3.83 to $14.69, average $10.96; of sprinkling filters (sewage pumped) from $6.49 to $23.83, average $13.85; of sand filters (all current cost excluded) from $6.97 to $21.67, average $11.90. Segregating the costs for labor, power and miscellaneous items, for the first type named above, labor constituted 34% of the total cost, power 56% and misc. 10%. For the second type, labor 79%, power 4%, misc. 17%. For the third type, labor 56%, power 32%, misc. 12%. For the fourth type, labor 86%, power negligible, misc. 14%.

The average costs per capita per year (population connected to the plant) were, for the first type 93 cts.; for the second type 57 cts.; for the third type 75 cts.; and for the fourth type, 47 cts.

*A five by four foot storm sewer built of creosoted timber by Des Moines, Ia.*

Apparently full-time technical supervision at the larger plants and part-time supervision at the smaller plants do not appreciably increase operation costs, possibly both because these items are comparatively small and because technical control secures more economical operation of plants as well as more uniform and better effluents.

**Gas Works Liquor** at Macclesfield, England[8], reached bacteria beds in the sewage, and at first caused a poorer effluent. But "in time the beds seemed to adapt themselves to the new conditions, and a stable effluent was produced; but when the discharge of gas liquor stopped they got a change again. It seemed as though the life in the bacteria beds adapted itself to the new conditions after each change in the character of the feed liquor."

At Chorley, all the gas liquor is discharged from the gas works into the sewer in one hour, and the sewage containing it is run into special tanks at the disposal plant, is then diluted and given preliminary treatment on sand filters, and 60 to 70% purification obtained.

**Aerated Sewage Flows** more slowly, or requires more head to produce a given velocity, than unaerated. The subject was studied[20] in a channel of the Milwaukee sewage treatment plant carrying a mixture of sewage and activated sludge into which diffused compressed air was introduced through diffuser plates in the bottom. From his experiments, Mr. Townsend derived the conclusion that the effect could be expressed approximately by using a roughness coefficient $n$ greater than the 0.013 applicable for unaerated sewage; making

$n = 0.035$ for a velocity of 1.3 per sec. and 0.0425 for 0.9 ft. per sec.—these being the limits of velocities occurring in the channel.

**Using Sludge Gas** for driving a blower which supplies compressed air to the aeration tanks of the sewage treatment plant at Springfield, Ill., has been continuous since February, 1933. W. B. Walraven, engineer of the plant, says[11]: "If the units continue to perform during the next four months as they have in the past nine, the engine and heat-salvage units will have paid their way completely." He says that "A great deal remains to be known about the use of sewage sludge gas for power. . . . The quality and quantity of the gas are variable from time to time; there may be excessive amounts of hydrogen sulphide present; the pressure at which the gas in generated may be too low; or, worst of all, the engine may not be large enough for the power unit which it drives. . . . But the experience at Springfield leads the writer to believe that so long as there are heat units in sludge gas, they may economically be put to work." The digestion tanks were formerly heated by means of a gas-fired boiler, but are now heated by the waste engine heat.

**Storing Sewage Between Tides** and discharging it on the ebb only may insure most of the solids being carried to sea, but if there is a long outfall which is closed at the land end, it will continue to discharge its contents for some time afterward and these may be carried ashore. To prevent this, G. M. C. Taylor (in England)[6] placed a valve at the outer end of the outfall.

**Building Outfalls** and similar work requiring divers and involving considerable risk should, Mr. Taylor believes, be let on the basis of cost plus a lump sum for overhead and profit, and bids be accepted only from contractors experienced in this kind of work. Underwater work which can be carried on only during favorable weather or certain stages of tide should be prosecuted night and day during such periods.

***Bibliography of Recent Water Works Literature***

*c*, Indicates construction article; *n*, note or short article; *t*, technical article.

*The Surveyor, December 15.*
1. Sewage Disposal Cost in Relation to Control and Management. By Walter F. Freeborn, pp. 551-553.
2. Wandle Valley Sewage Disposal, p. 561.

*December 22*
3. *n.* Pumping and Disposal of London's Sewage, p. 574.
4. Sewage Treatment and Fish Life. By Carl L. Hubbs, pp. 581-582.
5. Practical Sewerage Problems. By V. G. Pickering, pp. 587-589.

*January 12*
6. Disposal of Sewage of Seaside Towns. By G. M. C. Taylor, pp. 33-35.

*January 19*
7. Purification of Creamery Wastes, pp. 57-58.
8. Treatment of Gas Liquor in Sewage, pp. 59-60.

*Engineering News-Record, December 28.*
9. Sewage Treatment Costs at Thirty Illinois Plants. By W. Horner Wisely and Harry F. Ferguson, pp. 780-782.
10. *n.* Sewage Disposal Plan Advocated for Rhode Island Cities, p. 795.

*January 4*
11. Experiences in Operating a Blower Driven by Sludge Gas. By W. B. Walraven, p. 8.

*January 11*
12. Effect of Sewage on Cast-Iron Venturi Meters. By C. E. Keefer, p. 46.

*Municipal Sanitation, January.*
13. Sewage Disposal in Britain. By F. Johnstone-Taylor, pp. 8-10, 23.
14. Sewage Treatment Practice. By Willington Donaldson, pp. 11-12.

*American City, January.*
15. Operating a Mechanical and Air Blowing Activated Sludge Plant. By T. R. Kendall, pp. 56-59.

*Water Works and Sewerage, January.*
16. Unusual Features of the Lancaster Sewage Treatment Works. J. F. Labonn, pp. 7-10.
17. Cast Iron Pipe Used in Large Sewer Construction. By H. H. Hendon, pp. 23-24.
18. Reducing the Cost of Chlorinating. By C. H. Vivian, pp. 25-26.
19. Methods for the Aeration of Sewage. By H. E. Babbitt, pp. 27-30.

*Proceedings, American Society of Civil Engineers, January.*
20. Loss of Head in Activated Sludge Aeration Channels. By D. W. Townsend, pp. 63-71.

*Wood Preserving News, January.*
21. Storm Sewers Built of Creosoted Timber for Des Moines, pp. 10-12, 15.

*Public Works, January.*
22. Milk Wastes in Sewage Plants, p. 18.
23. *n.* Hydrated Lime in Imhoff Tank Operations, p. 19.
24. *n.* Purifying Beet Sugar Wastes, p. 19.
25. *n.* Combined Digestion Tank and Gasholder, p. 19.
26. Chemical Precipitation at Freeport, L. I. By Lawrence L. Luther, pp. 20-22.
27. *n.* Wisconsin Sewer Rental Law, p. 24.
28. The Digestion Tank, pp. 29-30.
29. Chlorine for Small Sewers. By G. S. Robins, pp. 38-39.

## Road Maintenance Costs in Rhode Island

*(Continued from page 23)*

.23 ct.; five, .23 ct.; six, .28 ct; seven, .30 ct.; eight, .33 ct.; nine, .33 ct., and fourteen, .98 ct.

The cost of maintenance for these five years of all pavements built in a given year can be seen by following the diagonals. For example, the costs of bituminous macadam pavements built in 1927 were .07, .20, .27, .003 and .30. Of those built in 1925, 3.56, 4.02, .15. .11 and .26. Of those built in 1924, .00, .10, .06, .12 and .07. These average, per year for these five years, 0.17 ct., 1.62 ct., and 0.07 ct., respectively; indicating how necessary it is to average a large number of pavements instead of only a few, to derive average costs. Also, that such averages can not be used successfully to predict cost on any given pavement. Also, possibly the difference in wearing quality between the construction methods employed in different years.

## Preventing Acid-Pollution of Streams by Abandoned Mines

In every section of the country where coal is mined, the streams are polluted by solid and liquid wastes, in many cases to the point where they are rendered useless for any purpose except removing these and other wastes and floating river traffic. Excuses for this are offered by the mining industry and plausible reasons why they can not afford to either prevent or remedy it.

But abandoned mines continue to pour out acid water without any offsetting advantage to any one. The acid is due to the oxidation of iron pyrites in the mines, forming sulphuric acid. It is probably impossible in most cases to prevent the flowing of water from these abandoned mines, since it must find some outlet; but it is possible to prevent the oxidation of the pyrites by shutting off the supply of air. This is being carried out as a CWA project in south-eastern Ohio, an allotment of approximately $130,000 having been made for this purpose. All discoverable openings are to be sealed air tight. Oxidation will continue until all the oxygen in the closed mine has been used up, and the drainage water will continue to be decreasingly acid; but there should be ultimately a total discontinuance of this acid pollution, which will not only protect public water supplies from contamination but will also result in material benefits to property owners by making streams available for stock watering which are now unfit for that purpose. In some of the large streams in the coal field districts it is expected that the project will bring about sufficient improvement in the condition of the water to permit the re-stocking of these streams with the types of fish life with which they formerly abounded.

# The Editor's Page

## Municipal Water Works and the Code

There is need for immediate action by the municipally owned water works companies of the country to secure adequate representation on the Code Authority provided for in the proposed water supply industry code, hearing on which will have taken place before this issue reaches our readers. This code is submitted by the Institute of Water Supply Utilities, an organization of private water companies, through its Code Committee, and provides that this committee act as Code Authority until a regular Authority be chosen; which Code Authority is to comprise representatives chosen by the Institute, by other private companies, and by publicly owned water works or for them by the Administrator for Industrial Recovery, to administer the code on all water works plants.

## CWA Work to Be Discontinued

For reasons which we have already discussed, the early anticipation that all of the $3,300,000,000 appropriated for PWA work would be assigned, and work on all assignments begun before winter, was not even approximately realized. In view of this delay in getting wages to the unemployed, a class of work known as CWA was adopted as a temporary measure to relieve the unemployment until the PWA work was in full swing.

There was no delay in starting CWA work, for several reasons: No elaborate plans were required; small jobs were permissible, to be performed by day labor; no bond issues had to be arranged for by the cities or counties; all the cost was paid by the Federal government. In a few days more men were at work under CWA than the total number employed under the PWA allotments. So popular has the CWA work been, that demands are pouring into Washington from all sections that this service be continued indefinitely. The President has said, however, that it will be discontinued by May 1st and we believe it will be and should be. For most of this work is not done economically; the hourly wages (though not the weekly) are high and cause trouble and discontent among regular workers receiving less; there is too much opportunity for political favoritism and graft in employing labor; the industries of the country should ultimately absorb the labor now under CWA, and meantime the regular PWA work should be expedited to help do so; contractors and equipment manufacturers would be injured by the collapse of PWA contract work which would probably result from continuance of the easily obtained CWA hand-outs.

There are plenty of projects acceptable under the PWA requirements for which money soon will be available. CWA money is merely a chock under the wheel to keep us from rolling back down hill into the depression, and we will never rise out of it so long as we are content to rest there. The government offers to furnish snatch teams to help us get to the top of the hill. Those who are too lazy or indifferent to accept the offer not only are doing themselves an injury but are blocking the way for those who are ambitious to return to the highland of prosperity.

Spring is only a few weeks off and another billion dollars' worth of regular PWA work should be ready to start and be in full swing by May 1st. Any municipalities which would be benefited by public works of any kind should arrange for a PWA grant and loan therefor; if they hope to have the work done by CWA labor they will, we firmly believe, be disappointed.

## A Way to Increase Municipal Taxes

More to the point, perhaps, would be ideas on how to collect the taxes already assessed; but just now so many tax owers simply can not pay them, that the other plan seems to be more promising.

If we assume that a certain percentage of all taxes will be uncollectable, there seem to be three possibilities: increasing the rates; increasing the assessed valuation; assessing more property. (It is taken for granted that every effort has been and will be made to reduce the necessity for taxes by economy in expenditures).

The third is the most difficult, but the most equitable and likely to yield by far the greatest increase in collections.

A few weeks ago representatives of a number of churches in a large eastern city suggested their willingness to help in the emergency by paying taxes on their property. This was a patriotic thing to do, but why should they not? In many cities between 10% and 25% of all the real estate is exempt from taxes. This generally includes property belonging to churches, hospitals, and all organizations not conducted for a profit, including colleges. In many cities church property is rented and helps support the organization, but pays no taxes.

Each of these (except municipal hospitals and colleges) are supported by individuals and not by funds from the public treasury, and the city has no control over their expenditures. Exempting them from taxes is indirectly contributing money toward their support. If such contribution is made, it should be open and apparent to all taxpayers.

Municipal waterworks, railways, toll bridges, and other money-earning utilities should pay taxes, and should in turn be paid by the municipality for services rendered. In New York, for example, the city's taxpayers pay part of the cost of carrying on the subways the millions of commuters and other non-residents who ride in them, because the fares collected do not suffice to pay all the operating and overhead charges. Moreover, unless these publicly owned utilities pay taxes such as would be assessed on privately owned ones, they are receiving part of their support from the taxpayers at large, and the actual cost of rendering the service can not be known. This discourages economy in operation and is considered unbusiness like and generally undesirable.

The most equitable way is to *tax all properties and utilities equally*. Then, if there is desire on the part of the municipal officials to aid any, do so openly by direct contributions in the budget.

*Diesel tractor on Mississippi levee work*

# Diesel Tractors Give High Fuel Economy

## *Operating Records on Several Classes of Public Works Construction*

**By Ralph J. Morgan**

A SOURCE of power for tractors which will greatly reduce fuel costs is especially welcome just now, when no one has "money to burn" and many contractors are expecting to invest in additional equipment to take care of the abundant work which promises to materialize this spring. The Diesel engine adapted to tractors is said to offer this advantage, the claim for saving apparently being substantiated by experience on various classes of work since the summer of 1931, when a Diesel-powered tractor was first offered by the Caterpillar Tractor Co. Figures from several of these experiences are given below.

### *On the Mississippi Levees*

The first Diesel was shipped to the Mississippi levees, the world's largest earth-moving job and toughest proving ground, being sold to the Driver Construction Co., which took special pride in it as the first Diesel on the river. It arrived at Lake Providence, Louisiana, in the fall of 1931 and had worked only three or four days when the job was shut down for the winter by bad weather and high water.

The high water did not go down until late in March, 1932, but as soon as it receded the Diesel went to work on a gruelling schedule of day and night operation, seven days a week. By December 1st, it had piled up a record of 5,856 hours of operation with no charges against it for repairs and no time out for breakdowns. That, in itself, is a remarkable record, but the fuel economy was even more impressive. Gasoline tractors were burning 6 to 7 gallons of 15-cent fuel every hour on this job, but the Diesel averaged 2.5 gallons of 5-cent fuel; a saving of 92 cents every hour or $5387.52 for the season. In other words, the Diesel had almost paid for itself in fuel saving alone in the first eight months of operation.

Over one hundred Diesel tractors have been purchased for work on the Mississippi levees during the last two years, many contractors having bought their first ones "sight unseen" after hearing what the machines were doing on neighboring jobs, and without exception they have been enthusiastic owners.

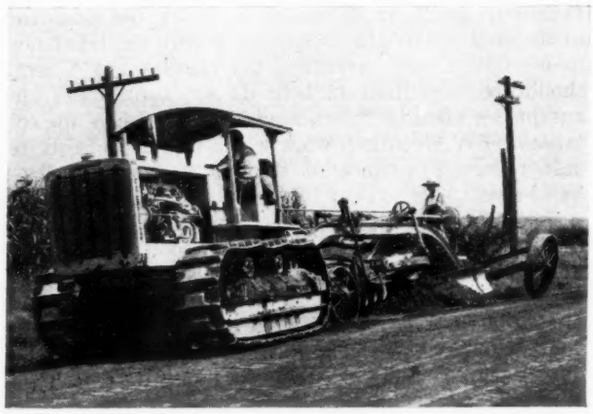
### *On Highway Work*

Ellis county, Kansas, builds roads that stay free from snow in the winter and have good drainage in summer by casting them up above the level of the surrounding country with an elevating grader. Officials report fuel consumption of 12 gallons per hour on the large gasoline tractor that they formerly used on this type of work. They bought a Diesel Seventy-Five in 1933, and found that it did the same work on 4 gallons of 3-cent fuel oil per hour. They had been paying 10 cents per gallon for gasoline, so the Diesel gave them a fuel saving of $1.08 per hour or $10.80 per 10-hour day.

Coweta county, one of the forty-five Georgia counties that now use Diesel tractors on their highways, had an opportunity to make a direct comparison between gasoline and Diesel power in their tractors, as they had two 50 h.p. tractors of the same make, one powered with a gasoline engine and the other with a Diesel engine. During the month of August, 1933, both of these tractors were operated the same number of hours on the same kind of work. The gasoline tractor burned 945 gallons of gasoline costing $110.85, while the Diesel machine burned 385 gallons of fuel oil costing $28.88—a saving of 74% over the gasoline tractor.

These records are not isolated cases, but are representative of the performance of Diesel tractors on thousands of jobs all over the world, in all of which they give more work for less money, the fuel economy being so great in many cases that it pays for the tractor in a fraction of its working life; thus duplicating records which Diesel engines have made in pumping and power plants for years past.

With a saving of fuel of possibly $1,000 to $5,000 in one season's work, a contractor or governmental body could well afford to pay double that, if necessary, as additional cost of such economical equipment.



*Diesel tractor on highway work*

# Highway Construction Novelties

*Rubber Road Carpeting*—Since 1931, experiments have been carried on in Singapore with rubber road paving made direct from latex and poured in place. In 1932, a cementing medium was introduced which fastens the rubber to the foundation allowing a reduction in the rubber thickness of from two inches to one-half inch for moderate traffic. By this method, 871 square yards of rubber carpeting were laid on Raffles Street in December, 1932, and opened to traffic in 12 days. The quantity of latex used was 2,236 gallons having a rubber content of 20 per cent. The cost was $3.90 per square yard. (One dollar, Straits currency= 2 shillings, 4 pence). The pavement stood the traffic well during the critical plastic stage and is improving perceptibly as time goes on.

*Heat Treatment of Clay Soils*—Experiments are under way in Queensland in the use of a traveling furnace for heating natural soils of heavy clay as it passes slowly over the road. The fusible constituents of the soil are melted. The soil is loosened or dug in front of the machine to a depth as much as 16 inches. After the heater passes, clay or other binder must be added and the surface can then be compacted. The machine in use prepares a strip 12 feet wide. Details of cost are not yet available.

*Cane Mat Foundation for Roads in the Netherlands*—A township in western Netherlands, which lies below sea level and where the soil is unstable mud of unknown depth, has had difficulty in getting permanent road beds to carry heavy traffic in the bulb districts. A trial section has been built using reed mats after their successful use in a railroad grade. The canes, or reeds, are very resistant to rot, having been used for roofs some of which have been in service for 250 years.

The reeds are impregnated with creosote, then woven into mats two inches thick. Drain tile are laid in the soil, a two inch layer of sand is placed on the subgrade, then the mats are placed and the surface is completed with brick filled with asphalt. The section of road will be opened in October and as there is heavy truck traffic, it is expected that the suitability of this type of road will be determined at an early date.

*Determining Retained Water in Aggregates*—Graham Bros., Inc., Long Beach, California, have developed a new weighing device for determining the absolute volume of the aggregates. The aggregates are weighed submerged in water, simultaneously with the weighing in air of the liquid and its container holding the aggregates. The objects are to provide means of determining the absolute volume of the aggregates, to keep the water volume constant and to provide a method of determining the absolute weights of aggregates when the specific gravities are known.

---

*Heavy Work on California Road*—Work has begun on the American Canyon route between San Francisco Bay and Sacramento which, in its 10.3 miles, requires the moving of nearly 1,200,000 cubic yards of earth and approximately 14,000,000 station-yards of overhaul. The drainage structures will require 10,800 cubic yards of excavation, 650 cubic yards of concrete and 35,500 pounds of reinforcing steel, and over 8,700 lineal feet of corrugated metal pipe in sizes varying from 8 inches to 96 inches diameter. This new route will cut 6 miles from the distance between Sacramento and the Carquinez bridge.


LINN-FRINK

SNO-PLOWS

*Surplus Power and Traction*

*for the deepest drifts*

LINN'S patented flexible traction and specially designed ice-creepers always obtain sure-footed traction in ice or snow. And the massive power of the LINN enables it to clear the entire width of the road on one trip. LINN has no equal in moving deep, tightly packed snow from the roads . . . For economically fighting snow with the LINN, the LINN-FRINK SNO-PLOW is recommended. It has successfully met all tests under severest conditions and is being widely used by counties and townships in the snow belt . . . If you are interested in equipment which will move snow, ice and heaviest drifts—keep roads open at high speed and at lowest cost—Write for bulletins on LINN snow fighting equipment. Or, call the nearest LINN office.

LINN

MANUFACTURING CORPORATION

MORRIS, NEW YORK

NRA MEMBER U.S. WE DO OUR PART

*Represented in principal cities of U. S. A. and Canada*

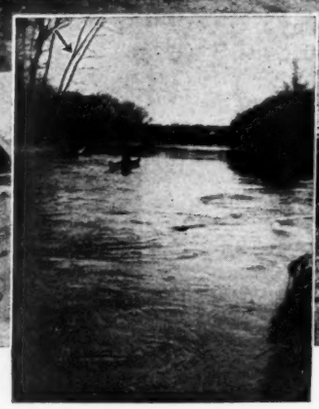
The LINN-FRINK SNO-PLOW is made expressly for the LINN MANUFACTURING CORPORATION by FRINK SNO-PLOWS, Carl H. Frink, Mfr. Clayton, 1000 Islands, New York

TOP—*The site of the new channel for the Saco River as it appeared after the blasters had shaken up the ground in June, 1932*

BELOW—*This is Walker Bridge. The engineers were concerned to make the river follow its accustomed path under this structure*

BELOW—*Had the Saco had its own way the Osgood Trestle, pictured here, would probably have been carried away by flood waters.*

BOTTOM CENTER—*Looking toward the channel entrance in May, 1933, after the Saco had cut through, forming a waterway sixty feet wide and eighteen feet deep*

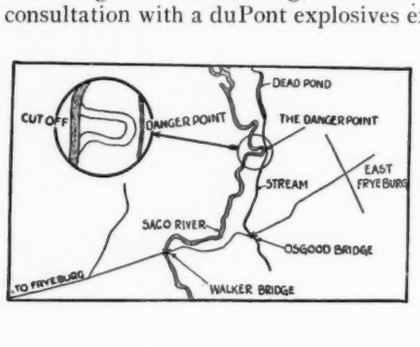


# Road Saved From Meandering River by Blasting Cut-off

THE Saco river flows through the township of Fryeburg, Maine, with a tortuous course. Paralleling it is another much smaller stream, which, for a half mile or so, is only a few hundred feet away. Both of these are crossed by the highway connecting Fryeburg and East Fryeburg, the river by a steel truss bridge, the smaller stream by a trestle. At two points above the highway, hairpin bends in the river bring it close to the smaller stream, and at the lower bend it approaches so close that a high freshet might cut across the intervening space and discharge the Saco into the smaller stream, with disastrous results to the trestle below.

This threat had for some years been a matter of concern to the state highway engineers, and in 1932 they decided to remove it by cutting a new channel across the bend, as shown by the accompanying map. Although the cut-off was located with a view to ease of excavation, the scrapers used soon uncovered roots, stumps and submerged logs (the river had probably flowed along this and numerous other courses during past centuries), which made the work so expensive and difficult that other methods of excavating were sought.

Among these was blasting, and this was adopted after consultation with a duPont explosives expert. The manner of using the explosives is described in DuPont Magazine, to which we are indebted for the information and illustrations.




*Showing the location of the Saco River and the stream nearby; also the Walker and Osgood bridges along the Fryeburg Road*

Because of the consistency of the soil, it was not considered necessary to make the new channel as wide or deep as the existing river channel; for, as the action of the explosive would loosen twice as much material as would be actually removed by the blast, the river flowing through this channel in flood would quickly erode and enlarge it to the necessary capacity, especially as there was ample fall—8 inches—to produce the velocity required.

Holes were put down with a post-hole digger at five-foot intervals along the center line of the proposed channel, to a uniform depth of 7 feet, and 35 to 40 pounds of duPont ditching dynamite placed in each, with heavier charges where stumps and logs were encountered, a total of 1,500 pounds being used. All were exploded simultaneously, there being enough moisture in the soil to propagate the shock wave from charge to charge. The resulting excavation was 35 ft. wide on top, 12 ft. at the bottom and 8 feet deep, a removal of about 1,400 cu. yd. of soil containing stumps and logs.

The bottom of the new channel was above the level of the water in the river, which was then—June, 1932—at its low stage. The first flood, however, sent part of the flow through it and the expected erosion took place. In May of last year the entire flow was passing 18 to 20 feet deep through the cut-off channel, which was 60 ft. wide, and silt was deposited at the entrance to the old channel. It was estimated that altogether about 7,000 cu. yd. had been removed in forming the new channel. "This river-diversion accomplishment is outstanding as one of the largest and most successful performances in which explosives have participated."

# Getting Highway Equipment Ready for Spring

(*Continued from January issue*)

*Trucks*

In making suggestions for putting trucks in condition for summer work, there are a number of matters to be taken into consideration. If the truck has been used in snow removal, it necessarily would require a more thorough check-up than if it had been stored during the winter months. Then again, a truck may have been partially overhauled and stored away in the fall without the thought of adding improved parts to increase the truck's performance, a point which should not be overlooked.

The Four-Wheel-Drive Auto Co. says regarding trucks that have been used in snow removal during the winter season:

As a rule, they have seen hard service and should be thoroughly checked for damaged parts. The frame and cross members should be inspected at the points where the plow brackets are fitted, to be sure that no parts have been sprung or cracked during the strenuous season just past.

Any parts which are bent should be straightened or, if they be cracked, they can be either welded or replaced with new members. All springs and spring clips should be thoroughly checked; the U bolts holding the springs in place should be drawn up tight and the shackles replaced if badly worn. The wheels should then be removed and cleaned, checking the bearings to be sure that they are in first-class condition. The driving spiders on the axle shafts should be examined to be sure that they are in good condition and that there is not too much play at the point where they fit on to the shaft, or where the arms fit into the wheel sockets. The differential housing should be drained and flushed and a new lubricant injected. If time permits, it would be wise to remove the inspection plates on the side of the housing and check over the tooth surfaces of the ring gear. When putting in the fresh oil, the new extreme-pressure lubricants should be used whenever they can be obtained.

After checking the axles, the front and rear propeller shafts and universal joints should be checked for back lash, to make sure that they are not worn excessively. The back lash in the transfer case also should be checked, and if excessive the chain should be tightened. The case should then be flushed thoroughly and refilled with the new extreme-pressure lubricants. The lubricant in the transmission should be changed, as well as that in the transfer case, and the same procedure followed. Where an oil-type clutch is used, the oil should be drained from the clutch and replaced with new motor oil of about SAE 20 viscosity.

In the motor, such units as the spark plugs, tappets, air cleaner and oil cleaner should be checked to make sure that all are operating efficiently. It is especially important in maintenance work that the air cleaner and oil cleaner be in first-class condition, as dust is unusually troublesome in this type of work. If there seems to be an undue amount of sludge in the oil drainings from the motor, the pan should be removed and thoroughly cleaned, but otherwise a regular flushing job will take care of any sediment which has accumulated. The cooling system should be thoroughly flushed in the reverse order, that is, the lower hose connection removed and water forced through the radiator in the opposite direction from the usual flow. This procedure will clean out a good bit of the sediment; however, if there are unusually large amounts, a caustic soda or commercial radiator cleaner should be used in the radiator before flushing.

The body and hoist fittings should be checked and the mechanism thoroughly tested before being put in service. If there is any doubt as to the procedure for checking any specific unit, instruction bulletins are available from the manufacturer of the truck.

Where units have merely been stored during the winter months, it would not be necessary to make the cleaning-up process quite so complete. The oils and grease should be changed to summer grade and it would be wise to check over such units as the oil cleaner, air cleaner and radiator. Where trucks have been overhauled during the winter months and given a cursory examination, it may be well to consider installing improved parts. For instance, if a universal joint is badly worn, it will pay to replace it with a new or improved type. If the truck is an older model, new carburetors and ignition systems can be installed to increase the operating efficiency as well as the speed of the unit. In some cases these old models are on solid tires which can be replaced conveniently and at small cost with pneumatic tires.

(*Continued on page 32*)

**PROFIT? A new Kinney Distributor**

**may be your answer:**

It's simple. High speed, safe heating plus high speed application means more profit.
ANY grade of asphalt, emulsion, tar, or road oils—
ANY quantity up to 3 gallons per sq. yd.
ANY width up to 20 feet.
SIZES—*600 to 1750* GALLONS
NOW IS THE TIME—WRITE

*Write for Bulletin A*

**KINNEY MFG. CO.**
3533 Washington St.
**BOSTON**

30 CHURCH ST., NEW YORK

725 Commercial Trust Bldg.
PHILADELPHIA
1202 Buckingham Bldg.
CHICAGO

407 Finance Bldg.
KANSAS CITY, MO.
1333 Sante Fe Ave.
LOS ANGELES

**STANDARD**
***SOCONY BRAND***

**ASPHALT PRODUCTS**

**Standard Cut-Back Surfacing Asphalt.**
**Standard Asphalt Binder A for surface treatment.**
**Standard Asphalt Binders B & C for penetration work (Asphalt Macadam).**
**Standard Paving Asphalt 51-60 and 61-70 Penetration for the mixing method (Asphaltic Concrete).**
**Standard Cold Patch Asphalt for all types of patching.**
**Standard Refined Asphalt for sheet asphalt paving.**
**Standard Asphalt Joint Fillers.**
**Standard Waterproofing Asphalt.**
**Specifications and all other particulars furnished on request.**

SOCONY ASPHALTS AND ROAD OILS

**STANDARD OIL COMPANY OF NEW YORK, INC.**
**A SOCONY-VACUUM COMPANY**
**26 Broadway**

*When writing*, we will appreciate your mentioning PUBLIC WORKS

*For Your Asphalt Plant*

**STORAGE BIN WITH PLATE FEEDER**

**Bin Can Be Sub-Divided . . . Furnished in Different Capacities . . . Shipped in Sections . . . Easily Erected . . . No Extra Power Required . . . Feeder Driven Off Cold Sand Elevator Boot Shaft . . . Provides Uniform Feed . . .**

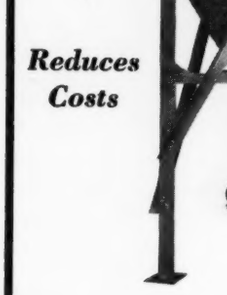
*Write for Details and Prices*

***Reduces Costs*** ***Increases Production***

**HETHERINGTON & BERNER INC.**

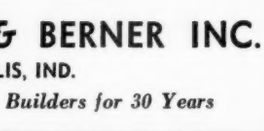
INDIANAPOLIS, IND.

*Asphalt Paving Machinery Builders for 30 Years*



**BUFFALO-SPRINGFIELD**

**Three Wheel and Tandem**



**Buffalo-Springfield's complete range of models in both three-wheel and tandem rollers permits the purchaser to select the proper machines for his work.**

***Full details will be furnished on request.***

**THE BUFFALO-SPRINGFIELD ROLLER CO.**

SPRINGFIELD, OHIO

*When writing,* we will appreciate your mentioning PUBLIC WORKS

The Indiana Highway Commission described its procedure last spring as follows: "On all of the trucks that need it, painting is being done, mechanical work is being attended to, new parts are being placed where excessive wear has been shown. Owing to our severe weather of early March, the trucks that we have to use have not been drained and the cooling system taken care of; but where we have laid up trucks for the express purpose of summer conditioning, the radiators have been given a thorough draining, also a thorough flushing with a sal-soda solution or some other cleansing agent to get rid of the rust, sludge and other foreign matter that necessarily detracts from the cooling possibilities of the radiator. Where it has been deemed extremely necessary, the engines are being overhauled entirely, chasses inspected for weakness and, if any tires were found to be defective, new ones are substituted. The bodies and hoists (we use only dump trucks) are being readjusted and repaired where it has been found needed."

### *Finishing Machines*

The following instructions are furnished us by the Blaw-Knox Company:

To check over the parts thoroughly, it is desirable to partially dismantle the machine. Remove both front and rear screeds, and, if their wearing parts are badly worn, replace with new ones. Renew the wearing plates (the section of the screed that rests on the road rail) and tune up the entire screed again. If tamper springs show considerable sag they should be replaced or retempered; also the flexible rubber shaft which operates the tamper should be replaced.

Examine the gear assembly. Any play in the bearings should be removed by removal of shims or rebabbitting the bearings. If there is excessive wear in the pitch of the gear teeth they should be renewed. The three clutches should be examined for wear in the clutch fingers and their cones.

In the end trucks which carry the machine on the rails, examine the drive wheels for excessive wear. If the drive chains are loose, adjust them to a tight fit. The gasoline motors should have their valves ground and pistons and rings put in first class condition, the crank shaft bearings should be checked for excessive play and should be thoroughly washed out and all outside grease and dirt removed. The carburetor and magneto also should be checked over. Finally, the machine should be repainted.

### *Graders and Maintainers*

In Indiana, equipment of this general type is in most cases provided with new blades; the operating mechanism is oiled and greased, and the whole machine is given a coat of paint.

### *Bins and Batchers*

Straighten damaged members of bins, test bolts and rivets for tightness, clean and paint. Check weighing batcher with manufacturer's erection drawing to make sure all parts are there, including test weights. Clean and oil all scale members. See that the plant meets 1934 specifications under which it is hoped to operate it.

### *Portable Tool Boxes*

Empty the tool box completely. Throw away or repair any damaged tools or parts. Paint the box inside and out, both for appearance sake and to prevent rust. See that sliding shelves, hinges and locking devices are all shipshape. A drop of oil here and there works wonders. Remove wheels, clean roller bearings; replace and repack with cup grease. Oil or grease

*(Continued on page 33)*

spring shackles. Replace the tools, arranging them in orderly manner.

*Tractors*

The Caterpillar Tractor Co. emphasizes the fact that it is far more economical to make a reasonable check-up in the spring than to take a chance of losing valuable hours during the summer. This company recommends that **the Caterpillar dealer or one of his servicemen go** over the machine. Points to be covered include a thorough cleaning, inside and out, preferably with steam; flushing of the cooling system, using a cleaning solution if necessary; and cleaning and flushing out the crank-case, transmission and final drive. In addition, valve clearances, clutch adjustment and track tension should receive attention.

Worn parts should be checked and replaced; dust seals and closures should be carefully inspected and, if worn, replaced. Magnets, electrical wiring and spark plugs need going over.

Tractors are used in Massachusetts principally or solely on snow removal work, and are repaired and overhauled during the summer. Indiana, and a number of other states, generally follow the outline given above in keeping tractors in shape.

---

## Incinerator and Sewage Works Combined for Canojaire

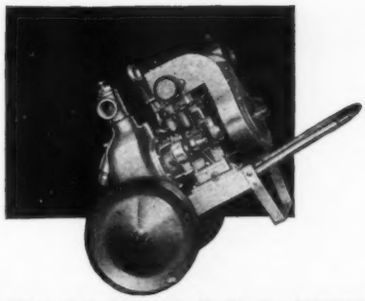
*(Continued from page 10)*

accessible. This tank will be equipped with a floating cover and the usual accessories. The settling tanks are located on a level with the basement floor of the building and the operator can divide his time between the stoking room, the settling tanks and the sludge tank without leaving the building. The construction required for sludge hoppers in the settling tanks is extended back under the building and forms a screen well and dry pump well.

The raw sewage is lifted about 10 feet to the settling tanks, which are located just about flood water level of the river. Effluent piping for the settling tanks will be installed in three locations in each unit—about five feet from the outlet end, at the center point, and at the quarter point near the inlet end. It is considered that the proper proportioning of the effluent drawn from these three different locations and from the top of the tank will give a better effluent, as in the case of activated sludge, than a single effluent channel or header located at the extreme end of the tank unit. It is also considered that it may be possible to prove that, with this effluent arrangement, sewage may be run through a tank unit at a higher rate, without depreciating the character of the effluent.

Three gas burners will be installed in three different combustion chambers of the incinerator and the gas from the sludge tank will be utilized to maintain temperatures in these chambers and to assist in the complete combustion of flue gases or used as auxiliary fuel, whichever may prove to be most advantageous. The housing of the sludge tank makes it accessible, avoids usual heat losses and maintains the compactness of the combination.

It is proposed to operate this combined plant with one attendant and it was therefore necessary to make all parts of the plant as readily accessible and convenient as possible.

Primes at over 25 ft. lifts—without hand adjustment.

No hand adjustment for recirculation cut-off.

Compact, rugged — one moving part.

3 times bigger water passages.

**GIANT CAPACITY, FASTEST 100% AUTOMATIC PRIME with JAEGER 2", 3", 4", 6", 8", PUMPS!**

Self-cleaning shell.

Timken or ball bearings.

No shaft packing.

Capacities 10,000 to 125,000 g.p.h.

Write for Prices!

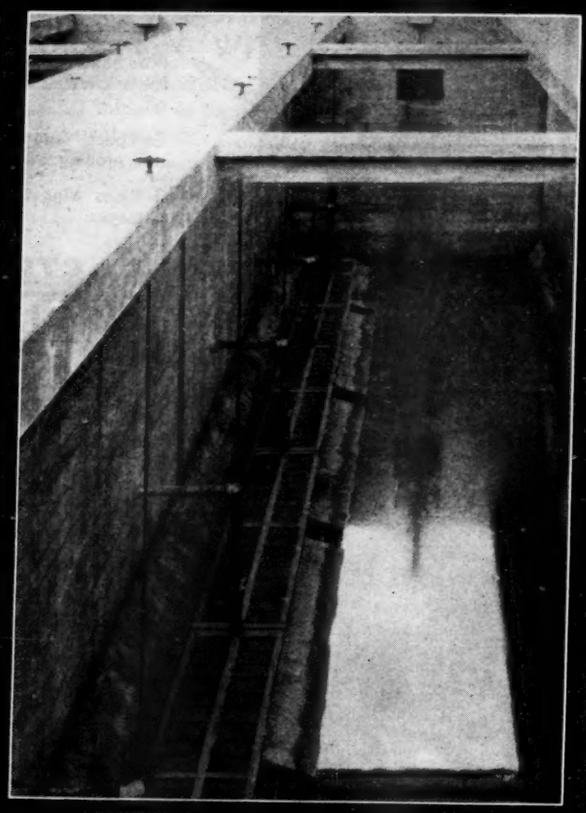
The Jaeger Machine Co.
400 Dublin Avenue Columbus, Ohio

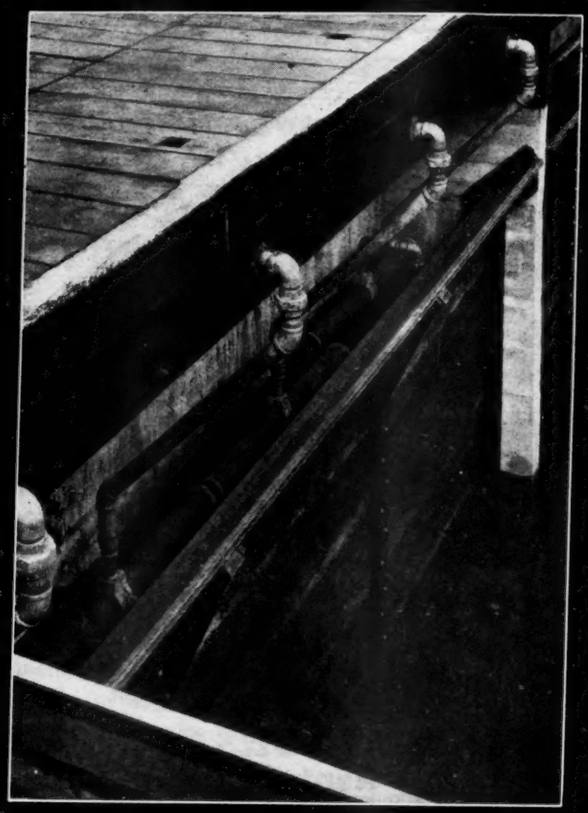
*For All-weather-proof Protection*
USE
**LE ROY DUR-A-BILT TENTS and TARPAULINS**

All sizes and grades in stock for quick delivery—at lowest prices. Also windbreaks, Highway Covers, Truck Covers, Bed Sacks—in fact anything made of canvas—at RIGHT prices. Try us!

*For prompt service, prices or information—wire or write to*
*Contractors' Division*
LE ROY TENT & AWNING CO.
3440 So. Grand Blvd. St. Louis, Mo.
Le Roy DUR-A-BILT Tents and Tarpaulins wear longer—cost no more

Hotstuf
TRADE MARK REG.
**CONTRACTORS EQUIPMENT**
**Asphalt Heaters**
**Surface Heaters**
**Paving Tool Heaters and Tools**
**Hi-Speed Trailer Tool Boxes**
DISTRIBUTORS IN PRINCIPAL CITIES
**MOHAWK ASPHALT HEATER CO.**
FRANKFORT NEW YORK





# Do Your Specifications Include Norton Porous Plates or Tubes?

**In cities throughout this country and across the Atlantic and the Pacific, Norton Porous Mediums—Tubes and Plates—are establishing enviable performance records.**

**Back of them is over thirty years' experience in the production of ceramically bonded products of electrically fused alumina. Back of them is many years of experience in the application of porous mediums to various kinds of activated sludge sewage disposal plants.**

**If you are interested in the design or construction of a sewage disposal plant of the activated sludge type it will pay you to make sure that the specifications include Norton Porous Plates or Tubes. Complete information about them on request.**

## NORTON COMPANY

WORCESTER, MASS.

NEW YORK CHICAGO CLEVELAND

**NORTON**
**POROUS TUBES AND PLATES**

R-472

**NORTON PRODUCTS**—Grinding Machines; Lapping Machines • Grinding Wheels; Abrasives for Polishing; India Oilstones, Pulpstones • Laboratory Ware, Refractories; Porous Plates • Non-slip Tiles and Aggregates

Do you make regular use of the Readers' Service Dept.?—see pp. 47-49

# Notes on Water Works and Sewerage

## Zinc in Water Supplies Not Poisonous

In 1925 a Public Health Service publication placed a limit of 5 parts per million of zinc in drinking water as a desirable maximum. One published August 11th, 1933, revises this opinion, saying: "So far as plain water is concerned it is certainly proper to conclude that a limit of zinc contamination of 5 parts per million is neither feasible nor necessary. Amounts greater than this are readily found and have not caused harm. If a limit is desirable, 30 parts per million is suggested for the following reason:

"When the source of zinc contaminating water is galvanized pipe—and this is the most common situation with which we deal—the zinc compounds in the water will be a mixture of oxide, hydroxide, and carbonate, the latter predominating. If present to an amount of 30 mg of zinc per liter, or 30 parts per million, zinc carbonate will cause appreciable milkiness in the water, and many persons will complain of an astringent taste. While there is no reason to consider this harmful, it is doubtful whether any community would tolerate it without incessant complaint. Both taste and appearance act to prevent zinc in its most common form from being a persistent contaminant of water supplies even in amounts which are harmless.

"It is significant that during the many years in which zinc-lined pipe has been in use no definite cases of acute or chronic illness have ever been traced with certainty to zinc.

"It may be asked whether chlorinated water constitutes a special case. On the basis of extensive data upon the water supply of the Franklin Plant of the New Jersey Zinc Co., Anderson, Reinhard, and Hammel conclude that chlorination reduces the attack of water upon zinc and is thus advantageous rather than the reverse. This conclusion is in accord with previous findings by Lothian and Ward."

## Sewers Forty-five Hundred Years Old

"The Oriental Institute's Iraq Expedition has found at Tell Asmar, 50 miles northeast of Baghdad, an ancient Babylonian city level dating from the 26th century B. C. It has a sewer running under an important street, which is connected with bathrooms and toilets by tile pipes to lead away the sewage." So writes Charles Breasted in an article in the National Geographic Magazine. He also says that, in excavating the ancient Persian city of Persepolis, built by Darius 2500 years ago, a passageway was found to "lead into a vast and complicated system of huge sewers or subterranean canals, through which the drainage from all the palaces was carried away. One can walk for several miles through this labyrinth today. . . . The total length of all the drainage tunnels beneath the Persepolis terrace has not yet been ascertained."

## Laying a 42-Inch Water Main Across a River

IN LAYING a 42" water main across the St. Joseph river in Fort Wayne, Indiana, W. C. Curd, superintendent for John Dehner, Inc., of that city, used a method which was unusual in some of its details.

The general plan was to excavate a trench across the river, which was about 220 feet wide; float the entire length of pipe, previously joined together, to position above the trench and lower it into the trench. This plan was of course not novel, but some of the details were.

The banks were 12 to 15 ft. higher than the river and the trench was carried to a grade 10 ft. below the river bed, using a 1½ yd. Sauerman "Crescent" scraper operated on a gravity return from a "Northwest" dragline machine; a track cable, leading from the hoist drum of the latter through a point sheave on the brow, being anchored on the opposite shore to a tractor, and the scraper being attached to this cable by a trolley and operated by a drag cable leading to a second drum on the dragline machine. As both this machine and the tractor were movable, the line of digging could be changed up and down stream as necessary.

*The combination of Scraper, Dragline and Tractor at work*

First a hole was dug in the river bottom at one bank by the machine and a bucket, to receive the material scraped from the trench. The excavation of this was a typical slackline operation.

The steel 42″ pipe was welded together into one length of 223 ft., continued for a few feet at each end at an angle to conform to the slope of the bank. This pipe was encased in concrete 6″ thick. Two pontoons of equal length were made of 42″ steel pipe joined by Dresser couplings and sealed at each end with removable heads, and the concrete-encased pipe was suspended between them by means of cables attached to ten pairs of hand winches mounted on timbers placed across the pontoons. When the trench was ready, the suspended pipe was towed to position above it and lowered into place. The trench was then backfilled by means of the dragline scraper.

---

## Arc Welding of Milwaukee's Standpipe

Milwaukee, Wis., in 1932 built a 6,000,000-gallon water tank, which was notable for its construction as well as for its purpose and design. According to Herbert H. Brown, in the "Journal of the American Water Works Association": "It was completely welded in the field by the electric arc fusion process, and to the writer's knowledge is the largest all-welded steel tank in the water works field in this country." The tank is 165′ diameter, 37′6″ to the overflow line, supported on a 12″ concrete slab pitched toward the center. "The bottom edge of each course was machined and the machined edges of adjoining corners joined with fillet welds both inside and outside. The vertical seams are solid butt welds. . . . The current for welding was supplied by 10 motor generator sets; each set was used by one welder. Each set was driven by a 6-cylinder gasoline engine and had 100 ft. of cable attached as a ground and 300 ft. of cable as a power line to the hand arc. The current used was at 45 volts and varied from 150 to 500 amperes, depending upon the thickness of the parent metal, the size of the weld rod and the speed at which the weld was being made. . . . This method necessitated considerable peening and chipping to remove all slag from the heart of the weld. . . . All butt joints were built by several applications or layers of weld metal with considerable peening performed between applications. Five applications were required to build up the joints on the heavier plates and two or three applications were used on the ⅜-inch plates."

The floor plates were butt welded; but there was considerable warping during welding and several of the edges had to be cut back to make butt welding possible. The author recommends lap welding bottom plates; that the tank side be completely erected before the floor is welded; that the floor plates be welded in warm weather, and under the side sheet be placed about 6″ higher than normal, with the foundation pitching sharply from a point 12″ from the side sheet. The vertical ends of the side plates were machined to form a V-joint; and "the bottom of each plate was machined by taking a cut off each edge, thus leaving a small horizontal section for bearing on the lower plate."

## Net Water Works Income Six Per Cent of Total Investment

After deducting operating expenses, depreciation and taxes, Holland, Mich., water department had a net income last year of a little more than 6.1% of the total amount invested and after paying off its last bonded indebtedness had a cash balance on hand of $46,131.

The Holland water department pumped 7.9% less water during the year 1932 than in 1931. Of this, 84.6% was registered by meters; it was estimated that 1.6% was used for flushing sewers and 3.3% for street sprinkling; leaving 10.5% used for flushing mains, under-registration of meters, and otherwise unaccounted for. At the end of the year, 3754 meters were in service.

Receipts from sale of water totaled $75,732, of which $21,215 was received from the city; $16,963 for hydrant service, $1,800 for street sprinkling, and the remainder for schools, parks, hospital, city hall, drinking fountains and fire department houses. In addition, $10,570 was received from sale of materials and sundries (on which there was practically no profit).

The water is derived from wells and pumped at three stations operated by electricity. (A steam plant drawing from a reservoir operated 21 days during the year.) The pumping operating expenses totaled $14,115; distribution, $4,675; commercial, $1,543; and general and miscellaneous, $4,461. The electric pumps consumed an average of 0.915 kwh per 1,000 gallons. The total operating expenses per thousand gallons pumped was 5.174 cts., of which 2.946 was pumpage, 0.975 distribution, 0.322 commercial and 0.931 general. Taxes, interest and depreciation brought the total cost of production to 9.63 cts. The average price received was 16.31 cts. per M gallons, or 12.2 cts. per hundred cubic feet.

The rates were 11 cts. per hundred cubic feet for the first 50 M cu. ft. quarterly, 10 cts. for the next, 9 cts. for the next, and 7 cts. for all over 150 M, with 10% cash discount.

For depreciation during the year, $13,512 was charged. The depreciation rates were 2% for pumping station buildings and fixtures, mains and services, office fixtures and other structures; 2½% for fire hydrants; 3% for reservoir; 5% for pumping station equipment at three stations and 7½% at the fourth; 5% for two of the well systems and nothing for the third; 5% for meters; and 6% for meter installation, and for equipment in the general office, stores department and elsewhere. The total investment in the plant has been $526,965, and the total depreciation charged, $161,068. During the early years of its existence it received $173,500 from taxes, but has been self operating since then.

The net income, after deducting operating expenses, depreciation and $7,827 for taxes, was $32,168, which was 6.1% on the investment. During the year the department paid its last bonded indebtedness—$1,000—and is now entirely free from long-term indebtedness. At the end of the year it had $46,131 cash on hand and no liabilities.

The department is under the supervision of the Board of Public Works, of which A. Nanta is superintendent.

# Sewerage in Nagoya and Kyoto, Japan

**By Isador W. Mendelsohn**

*Horidome, Nagoya, treatment plant. Buildings covering tanks in the background.*

NAGOYA, with 907,000 population and 2,000 factories, is the third largest city of Japan, covering an area of 57 square miles.

A system of combined sewers, begun in 1907, in 1929 served 10.6 sq. mi. in the center of the city with 273 miles of sewers to which 95% of the residences therein were connected. They discharged into canals extending through the heart of the city, which became grossly polluted; and two activated sludge plants were, in 1930, completed to serve two of the three districts into which the city was divided.

One of these, the Horidome, was designed for 300,000 people and now serves 230,000; having a capacity of 11 mgd dry weather flow and 33 mgd in case of storm. It is divided into two parts, one for a high-level section and one for a low, each of which includes a two-compartment grit chamber, two screens (those for the high level having mechanical rakes); 3 preliminary settling tanks; 4 flat-bottom spiral-flow aeration tanks, each divided into three channels to give a length of travel of 468 ft. at a velocity of 1.5 ft. per minute; 8 settling tanks giving a detention period of 1.7 to 1.88 hrs.; 2 reaeration tanks, and a sludge storage tank. Air is supplied in the tanks at the rate of 2 cu. ft. per gal. under 9 lbs. pressure, through diffusers with an area one-twelfth the tank area. Activated sludge equivalent to 25% of the raw sewage is returned to the tanks, and the excess sludge is pumped to the other plant, the Atsuta, where the excess sludge from both plants is pumped four miles into the harbor outside the breakwater. The tanks of the Horidome plant are enclosed in attractive concrete buildings.

The Atsuta plant serves a population of 130,000 and is designed for 294,000. It is similar to the Horidome plant except in minor particulars.

Tests have been made of use of Oliver filters and of sludge digestion. Because of the cost of chemicals for conditioning sludge for the filters, sand beds are under construction for filtering the excess sludge. Chlorination also is contemplated. Two hundred thousand yen were appropriated this year for additional sewers and a third treatment plant.

Kyoto, population 765,142, is Japan's fifth largest city, covering an area of about 18 sq. mi. All houses and other buildings have individual septic tanks which can not legally be connected to the storm sewers, which discharge into the canals. Private companies collect the tank contents at a charge of one yen a month and carry it in barrels or hand carts to neighboring farms. The city is planning for sewage treatment and an experimental plant was built in 1933 at a cost of 520,000 yen to treat the sewage of 60,000 people, estimated at 45 gal. per capita. This will be operated as a test plant for four or five years. It includes a bar screen with one-inch openings and mechanical cleaning, a grit chamber 14 ft. square, a venturi flume, an 80-ft. square clarifier, open aeration tanks, a 60-ft. square final settling tank, a 65-ft. diameter covered sludge digestion tank with gas collector, open sludge drying beds or filters, chlorinator, laboratory, centrifugal pumps, sludge pumps and blower.

For the above information the author is indebted to Tsunejiro Kawahara, K. Muramatsu and Messrs. Nomi, Chuzyo, Kaihuchi and Shionoya.

---

## Germany's Climate and Sanitation

The southern part of Germany is in the same latitude as northern Maine and the northern part corresponds in latitude to the central part of Labrador. Lower average temperatures therefore prevail in Germany as compared with the United States. A study of available stream flow records of German rivers also seems to indicate that there is a much smaller spread between average and minimum flows than is the case in most sections of the United States. The combination of generally lower temperatures and higher minimum stream flows is responsible for a reduction in sewage treatment requirements. The smaller need for electric fans and electric or other refrigeration, the small number of flies and the reduction in the necessity for screening, and the satisfactory disposal of refuse and garbage by dumping it in excavated areas or in piles are attributable to more favorable climatic conditions than we have in the United States.—*Clarence B. Hoover, in "Public Management."*

**Use PFT Equipment *for* Sewage, Water *and* Industrial Waste Treatment**

***Write for Latest Bulletins***

**PACIFIC FLUSH TANK COMPANY**
Designers & Manufacturers of Sewerage and Sewage Treatment Equipment
4241 RAVENSWOOD AVE. CHICAGO, ILL.
EXCLUSIVELY SINCE 1893
136 LIBERTY STREET NEW YORK, N.Y.

RUBBERIZED COVER

*We welcome an opportunity to quote on your requirements.*

*Safety First!*
**BUILD WITH STEEL CASTINGS**
Manhole Covers
Catch Basin Grates
Curb Inlets
Monument Boxes
Manhole Steps and other Steel Castings

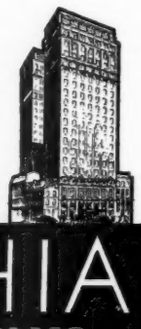
**NOISELESS, DURABLE HIGHWAY CASTINGS**
THE WEST STEEL CASTING CO.
CLEVELAND, OHIO

The Ideal **LOCATION** in PHILADELPHIA

Everything worthwhile in Philadelphia is at your very doorstep when you stop at Hotel Adelphia. Every point of historic interest ..stores...theatres...are easily reached. Here at this fine hotel you can enjoy every comfort and every luxury at low cost.

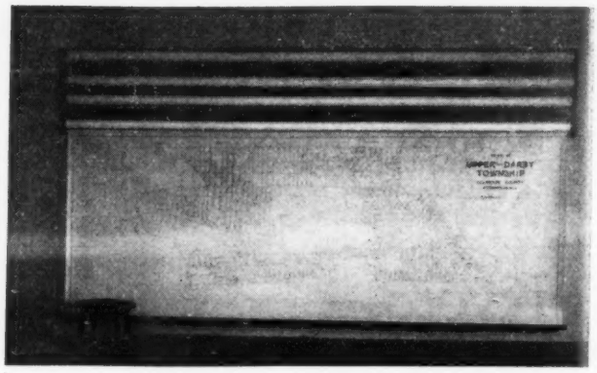
400 ROOMS
from $3. single from $5. double

ADELPHIA HOTEL COMPANY
DAVID B. PROVAN *Managing Director*



HOTEL ADELPHIA
CHESTNUT AT 13TH STREET

***When writing,* we will appreciate your mentioning PUBLIC WORKS**



*Wall Maps of Upper Darby Township*

key-maps in connection with the filing system. For example: the "Sewer Lateral Key-Plan" is divided into sections corresponding with the plans on file, and in each such division on the map is noted the file number of the associated plan. (See illustration.) These key-maps have been prepared for the various classes of plans filed, and are wonderful time-savers when locating a plan from the file drawers.

The mounted small maps are used in a number of other ways. One has all fire hydrants platted, with a 600′ radius circle drawn about each to show the amount of fire protection afforded. (See illustration.) Another has the paving materials of which the various streets are constructed indicated by different colored inks. Still another shows each of the 1745 street lights in the township, with the candle power and pole number. This makes it a simple matter reporting a "light out" or dangerous pole to the utility company.

Too much system is almost as bad as none, but the ideas advanced above can be adapted to the use of any municipal engineering office. The key-map system has been tried and proven, and is unhesitatingly recommended as an aid to efficient public service.

## Assessing Damages for Sewage Pollution of Rivers

A law relative to the sewage pollution of rivers by cities went into effect in Massachusetts last October* which embodies an idea for treating that matter which we believe to be novel.

To protect oyster consumers, the state department of public health is required to examine tidal waters and flats from which shell fish are taken, and if it finds that pollution in any of them makes it unsafe to use for food shell fish taken therefrom, it is unlawful to take shell fish from such area unless they are purified in an approved plant before being used. If the shell fish industry at that point warrants it, the department may approve the construction and operation of a purification plant by the city or town in which the polluted shell fish area lies; and "determine the sources of pollution of the contaminated area or areas, and the proportions in which cities and towns within the commonwealth are causing or contributing to the cause of such pollution"; and the cost of constructing and operating the plant shall be paid by such cities and towns each in proportion to its share in causing the pollution.

Presumably a city satisfactorily operating an adequate sewage treatment plant would not have to make

*Chapter 129A, sections 69 to 80

any such payments, and this might offer quite an inducement to communities to construct sewage treatment plants.

If this principle holds for the benefit of the shell fish industry, it would seem to be logical to apply it to the benefit of cities which take their water supplies from polluted streams, requiring all polluters of a stream above a given city to reimburse such city for the cost of building and operating its water purification plant. This would seem to meet the objections raised by many cities, as for example by Waterloo, Ind., whose *Press* said recently: "So long as Fort Wayne is not going to build a sewage disposal plant to take care of the waste of that city, there is not much reason why Waterloo should do so for the sake of Fort Wayne's water plant."

## Improving Refuse Collection and Disposal

ASKING in its title "Can Refuse Collection and Disposal Systems Be Improved," Harrison P. Eddy presented a paper before the Public Health Engineering Section of the A. P. H. A. in which he suggested means of doing so. Among these were the utilizing of technical university graduates in the routine operating services; insuring availability of adequate funds, as by collecting service charges against the householders for the refuse service and earmarking this money for that service; basing all appointments on merit; improvements in designing and operating refuse disposal works, and in collection equipment.

Improvement in designing disposal works will tend toward longer life and simplified operation. Improved operation involves operation at a uniform rate throughout the day; alternate heating and cooling may give unsatisfactory combustion at low temperature, and rapid deterioration due to rapid expansion and contraction of the incinerator parts. Also designing for 24-hour operation rather than 8-hour results in smaller plants and lower capital charges.

Rigid cleanliness is important. It will result in a much higher morale among the operating staff and consequent improvement in the care given the plant and therefore increased life, and in the efficiency of operation; and these will cause a greater respect for the department and more generous appropriations.

The collection system offers the greatest opportunity for improvement in studying the various problems on a unit basis, such as work done in cubic yards, tons, man-hours, vehicle-hours, rather than by comparing total costs of one city with those of another. "Probably there are no two cities where the per capita cost of an equally efficient service using identical equipment would be the same. . . . Efficient operation of a refuse collection service demands the driving energy of a practical man" and, in the larger cities, of a trained engineer to gauge unit costs and efficiency and readjust district and route boundaries from time to time. The work should not be in the hands of boards of health, doctors or laymen.

In some of the better organized collection services each collection crew is given its daily stint, requiring long hours in stormy weather and during peak seasons (without additional compensation) offset by ability to clean up its district in considerably less than 8 hours at other times.


# LAUGHLIN CLARIFYING TANK

## *Low Power and Low Operating Cost*

**Provides more complete removal of suspended solids from sewage and industrial wastes.**

**Permits of usual sedimentation and thickening operations within a tank, at high capacity for a given tank size.**

**Removes solids by positive filtration through a filter bed which extends around entire circumference of tank, extending inwardly five feet or more.**

**A traveling magnet cleans the filter bed as necessary.**

**Tanks of round or rectangular type for any capacity.**

**Low power and low operating cost.**

***Write for illustrated folder and complete details***

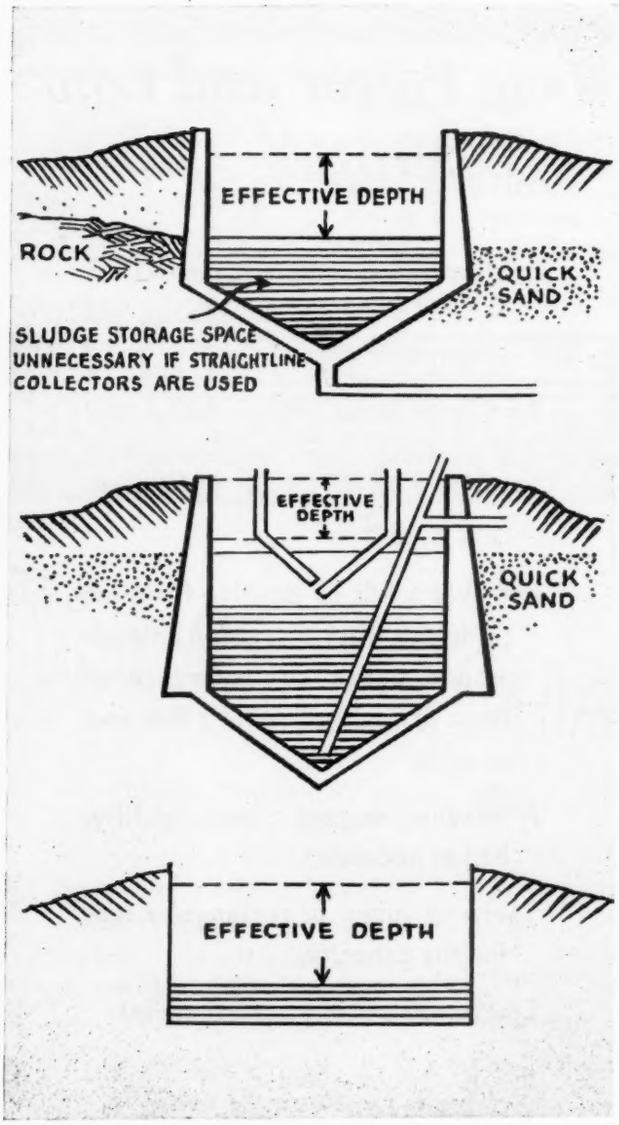
**FILTRATION EQUIPMENT CORPORATION**

**350 Madison Ave. New York**

*When writing,* we will appreciate your mentioning PUBLIC WORKS

Short Talks With
Sewage Plant Designers

# DEEP TANKS
## *are expensive*



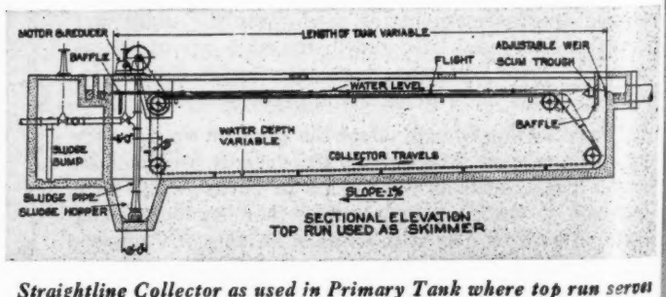

**A TANK fifteen feet deep may cost five times as much as one eight feet deep, especially if rock or quicksand is encountered.**

***Why pay for sludge storage space in deep tanks?***

**Depth is a serious disadvantage of the two-story Imhoff tank. It is not so generally recognized that this objection applies to *any* tank from which the sludge is not removed at least once a day. The effective depth of a sedimentation tank extends only to the top of the sludge when the accumulation is deepest. From this level down, is simply sludge storage space, and a more expensive place to put it could not be found. If the tank bottom consists of a series of hoppers for drawing off the sludge, the additional 4 to 8 ft. depth of these, adds greatly to the cost.**

**The cheapest tank to construct is one 8 or 10 ft. deep, with a flat bottom and straight sides; and, given the right proportional width and length, and good influent distribution, it is also the most effective, if the sludge is removed regularly and not allowed to accumulate anywhere to an appreciable depth.**

**Regular, complete removal of sludge from rectangular flat-bottom tanks, is performed efficiently by the Straightline Collector, which for more than twelve years has given satisfaction in scores of plants.**




*Straightline Collector as used in Primary Tank where top run serves also as a scum collector.*

LINK-BELT COMPANY

PHILADELPHIA, 2045 West Hunting Park Avenue — CHICAGO, 300 West Pershing Road
SAN FRANCISCO, 400 Paul Ave. — TORONTO, Eastern Ave. & Leslie St. — Offices in Principal Cities

4921

LINK-BELT

SCREENS ▲ COLLECTORS ▲ AERATORS ▲ GRIT CHAMBERS ▲ DISTRIBUTORS

*When writing,* we will appreciate your mentioning PUBLIC WORKS

# News Flashes

## Reports of Interest to the Engineering and Construction World

### A.S.C.E. Elects Harrison P. Eddy President at 81st Meeting

NEW YORK, N. Y.—At their 81st annual meeting held in this city Jan. 17th to 20th the American Society of Civil Engineers elected as president a leading sanitary engineer—Harrison P. Eddy. The John Fritz medal was presented posthumously to John R. Freeman; the Norman medal to Prof. Hardy Cross; the Croes medal to Col. Earl I. Brown; the Rowland prize posthumously to John C. Baxter; the Laurie prize to W. B. Saunders; Wellington prize to D. J. Kerr; Collingwood prize to Bernard L. Weiner, and the Noble prize to C. Maxwell Stanley.

The City Planning Division dealt chiefly with nation-wide planning, including highway and other transportation and the conservation of natural resources. The Highway Division in two papers described the elevated roadway along the Hudson River in New York City and the super-highway leading from the Holland Tunnel through the adjacent New Jersey urban district

Studies of underground corrosion of metallic pipes by the Bureau of Standards were described by A. H. Logan. Soil conditions were found to be more important than character of pipe material, the most important condition being the oxygen concentration. Corrosion can be reduced by using copper or copper alloy pipe, increasing thickness of pipe wall, or protective coatings.

In a paper "On the Flow of Water Through Sand," Prof. Fair discussed the application of Poiseuille's formula for stream flow at greater length than he had done in his paper before the American Water Works Association. (See Journal of the Ass'n for November.)

PWA work in Missouri; Tennessee Valley Authority and other public ownership of power; bridge floors and other structures; field engineering; and the U. S. Waterways Experiment Station at Vicksburg, Miss. were the subjects of other papers and discussions.

### B. C. Tiney and Fred Burggraf Join Calcium Chloride Ass'n

DETROIT, MICH.—Two recognized specialists in the science of soil stabilization have been added to the staff of the Calcium Chloride Association.

One of these is B. C. Tiney, of Lansing, Mich., who has been named as chief engineer of the Association. Mr. Tiney formerly was maintenance engineer of the Michigan State Highway Department and is chairman of the Maintenance Committee of the Highway Research Board.

The other is Fred Burggraf, formerly a research engineer for the Highway Research Board, who has been appointed as soils engineer. He recently has been making stabilization surveys for the Association of Missouri, Minnesota, Wisconsin and other states.

Both of these men have paid special attention to the development of low-cost roads through stabilization and the incorporation of calcium chloride as a binder in the road surface.

In connection with the research and field engineering work being conducted by the staff, the Association is now prepared to supply upon inquiry copies of its Bulletin No. 12, "Tentative Specifications for Low-cost Road Surface Stabilized with Calcium Chloride and Natural Soil Binder."

The Association recently has moved to larger quarters at 2075 Penobscot Building, Detroit, Mich., according to announcement by Ray A. Giddings, secretary. This move was necessitated by the expanding activities of the Association and by recent increases in its staff, he said. Members of the Association are the Columbia Alkali Corporation, Dow Chemical Co., Michigan Alkali Co. and Solvay Process Co.

### 5,614 Public Works Highways Projects Now Under Way

WASHINGTON, D. C.,—Progress made on emergency construction of public works highways to January 20 under the supervision of the U. S. Bureau of Public Roads shows a total of 5,614 projects, estimated to cost $289,958,000, had been advertised for contract or begun by day labor employed directly by the highway authorities. The cost of the day labor projects included in the above is estimated at $20,651,000.

Of the 4,852 projects awarded for construction, 3,140 were under construction on January 20, and 544 were completed. The work under construction, which is estimated to cost $181,996,000 was giving regular employment to 133,169 men.

In the whole country, work advertised for contract or started by day labor employed directly by the highway authorities involved 67.6 percent of the $400,000,000 provided for public works highways under Section 204 of the National Industrial Recovery Act.

### E. B. Besselievre Heads N. Y. State Sewage Works Ass'n

NEW YORK, N. Y.—Following its regular practice, this association held its sixth annual meeting on the day previous to the meeting of the American Society of Civil Engineers, January 16th; and in the evening joined with the Sanitary Engineering Section of that society in a banquet. The morning and afternoon up to 4:30 were devoted to papers and discussions; and at 4:30 a visit was made to the new sanitary engineering laboratory at New York University. Wednesday morning a considerable number visited the treatment plant at Rockville Center, Long Island, through the courtesy of the Municipal Sanitary Service Corporation.

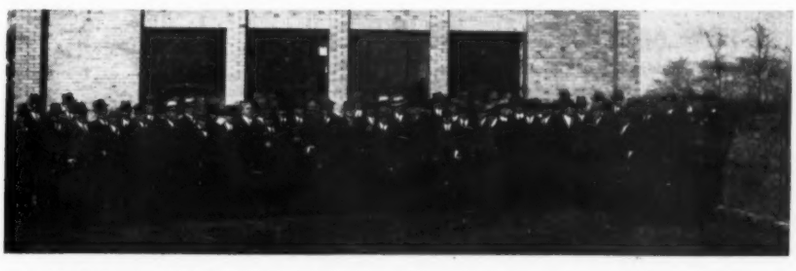
Edomund B. Besselievre was elected president, and Morris M. Cohn vice-president; while A. S. Bedell was reappointed secretary-treasurer.

The first paper, which was discussed at length, was by Prof. Earle B. Phelps, in which he reviewed the studies made for 25 years past on pollution of the Hudson river and New York harbor, following with a preliminary report on his own recent studies. He stated as significant that there has been a continuous but not uniform increase in dissolved oxygen deficiency during these 25 years.

In discussing "Digestor Overflow Liquor," Dr. A. J. Fischer, of the Dorr Co., described five methods of disposing of this highly polluted water, drawing it off with the sludge, giving a thin sludge; chemical treatment; storage to precipitate the solids; intermittent filtration on sand beds; and returning to the raw sewage where it enters the plant. (The last is claimed to be covered by the Morgan patent.)

C. E. Keefer described comparative results in two digestion tanks run in parallel at Baltimore, one with and one without circulation of sludge. These did not seem to indicate any material advantage in circulation.

The results from six months of operation of a demonstration plant at Chicago employing the Guggenheim process were given by G. H. Gleason, showing an 89% removal of B.O.D., 90.4% of suspended solids, and 97.7% of bacteria,



*Members of N. Y. State Sewage Works Association who visited plant at Rockville Center, N. Y.*

*Winter is no obstacle to Federal Recovery Program. Men at work on PWA highway project near Pittsfield, Mass.*

using something over 2,500 pounds of chemicals and producing a filter cake with 76.4% moisture. Construction of such a plant is estimated to cost from $36,000 to $71,000 per m.g.d. capacity; and operation, including capital charges, $32 to $52 per m.g., of which $9 is for chemicals.

### Link-Belt Acquires T & M Tunnel Shield Rights

PHILADELPHIA, PA.—Link-Belt Company has acquired an exclusive license to build and lease T & M Tunnel Shields for the construction of inside diameter tunnels from 4 ft. to 8 ft. inclusive, and work is to begin at once on the construction of additional machines. This new activity of the Link-Belt Company will have headquarters at their Philadelphia Branch, 2045 W. Hunting Park Ave., and it is understood that the present staff of Tunnel and Mine Machinery Co., owners of the patents, will assist the Link-Belt staff on both the engineering and sales promotion. Full information may be had by addressing Link-Belt Company, or the Tunnel & Mine Machinery Company, 814 Otis Bldg., Philadelphia, Pa.

### Jeffrey Mfg. Co. Opens Offices in Cleveland and Cincinnati

To more efficiently serve the demands of the surrounding territory, the Jeffrey Manufacturing Company has opened offices in the Carew Tower Building, Cincinnati, and in the Rockefeller Building, Cleveland.

Their many years of experience in the Jeffrey organization have well equipped Mr. Lyle Martin at the Cincinnati Office and Messrs. G. D. Francisco and J. R. Warren at Cleveland to deal with industrial elevating, conveying and reduction problems.

### "A Century of Progress" in Authentic Colors:

The American Asphalt Paint Co., makers of "Valdura" Products, announce that their new brochure "Color and Protection" is now ready for distribution. This is a book of authentic water-color illustrations of "A Century of Progress."

Having been awarded the contract to furnish and apply the paint for all major World's Fair buildings (inside and outside), this company is especially interested in making their book an authentic record of the progress of color in industry.

The Fair Management has credited this book os being the only reproduction of the genuine flat color effects as designed by the late Joseph Urban. It is printed in 13 water-colors, silver and gold and contains 35 of the finest reproductions of the actual buildings and actual colors yet created.

You can obtain a copy of this 16-page souvenir book by writing, on your company letterhead, to the American Asphalt Paint Co., 43 E. Ohio Street, Chicago, Illinois.

### Catalogs—Just Off The Press

*Construction Equipment* — Austin-Western Road Machinery Co., 400 N. Michigan Ave., Chicago, Ill., has just issued a new general reference catalog for 1934. Pictures of their equipment out on the job are used to illustrate their complete line for every approved method of construction and maintenance.

*Drill Steel Furnaces.*—Sullivan Machinery Co., 400 No. Michigan Ave., Chicago, Ill., has issued a catalog on portable drill steel furnaces. A complete and worthwhile booklet.

*Airveyor.*—The Fuller Co., Catasauqua, Pa., has issued a catalog and booklet covering pneumatic conveyors for fine, crushed, and granular material. These conveyors are especially adapted for use in handling waterworks chemicals.

*Pavements Resurfaced with Concrete,* a new 20 page booklet based on an expensive survey of concrete resurface projects all over the country. Includes table giving recommended thickness and design for varying conditions of traffic and support. Available on request to Portland Cement Association, 33 West Grand Ave., Chicago, Ill.

## American Road Builders Ass'n.

THE 1934 Road Show and Convention of the American Road Builders' Association, which was held at the Stevens Hotel, Chicago, Ill., Jan. 22-26, quite made up in quality what it lacked in quantity. Registration was but a fraction of former years, yet those present were important men in the road-building field and at the meeting generally for a serious purpose. Official figures of attendance have not been made available to us, but probably not more than 2,000 were registered.

The exhibits were well planned and interesting. Of necessity, with space limited, reliance was not placed on bulk. Educational material, moving pictures, and similar types of exhibits predominated. There were about 100 exhibitors.

The technical sessions were well attended. For the most part, these stressed matters of current interest—codes, CWA and PWA work and the organization necessitated thereby. The Highway Contractors' session on Tuesday afternoon, at which was discussed the "N.R.A. Code, and Rules and Regulations for Highway Contractors" brought out considerable comment and discussion.

Civil Works projects were disucssed at the joint session Tuesday afternoon of the City and County Highway Officials divisions. R. Keith Compton and Hal G. Sours, presidents, respectively, of these divisions, presided. "Simplified Record Keeping for Public and Civil Works Projects" was covered by Donald C. Stone of the Public Works Administration, Washington; "The Administration of Civil Works Projects," by Frank D. Chase, director and chief engineer of the Illinois CWA; and "The Selection and Supervision of Civil Works Projects in Ohio," by G. J. Kane, chief engineer of the Ohio CWA. These were all of interest and value.

Both city and county divisions had separate sessions later in the afternoon, with M. O. Eldridge, assistant director of traffic, Washington, D. C., speaking on "Can Traffic Fatalities Be Reduced," before the city officials; and highway and civil works projects again coming before the county section.

The annual banquet, held Tuesday evening, was very well attended, and was one of the most successful yet held.

The Wednesday forenoon general session included an interesting paper by J. B. McCord of the Bureau of Public Roads on the maintenance cost studies now being carried on by the Bureau. H. F. Cleunuer spoke on "Early Strength Concrete" and Talbert Abrams on aerial photographic surveys and their use in road work.

The Pan American section had a dinner meeting Wednesday evening at which Angel Aragon, sub-director general of Highways of Mexico presided and at which a number of addresses were given.

The technical sessions closed with the Thursday morning open forum session of the National Highway Advisory Council at which were discussed plans for a continuing highway program. The annual business meeting of the ARBA was held Thursday afternoon.

# Need Special Information? Use this Readers Service

## Snow Removal

344. "Control Winter Drifts"—A new folder giving full details regarding use and construction of the Mattson snow fence has just been issued by the Mattson Wire & Mfg. Co., Peoria, Ill. Illustrated in two colors.

345. "Standard and Heavy Duty Reversible Blade Snow Plows for Motor Trucks," a new bulletin just published by the Monarch Mfg. Co., East Front St., Wilmington, Del. Illustrated. Contains complete descriptions and specifications.

349. "The Answer to the Snow Removal Problem." It gives full details of the Frink type S snow plow for trucks. Carl Frink, Mfr. of Clayton, N. Y.

359. Galion Iron Works and Mfg. Co., Galion, Ohio. Details, prices and catalogs of their snow plows adaptable to any make of truck.

## Sanitary Engineering

### Activated Carbon, Aqua NUCHAR

380. For low cost removal of tastes and odors from potable waters. Used by more than 400 municipalities. For literature address Industrial Chemical Sales Company, Inc., 230 Park Avenue, New York.

### Ferric Chloride

382. Full information concerning the experiences in the use of ferric chloride for use in sludge conditioning and in coagulating sewage will be sent promptly by Innis, Speiden & Co., 117 Liberty St., New York, N. Y.

383. Loughlin Clarifying Tanks for the more complete removal of suspended solids from sewage and industrial wastes at lower cost are described in a new bulletin just issued by Filtration Equipment Co., 350 Madison Ave., New York, N. Y.

### Sludge Drying

385. Relatively dry cake sludge in demand for fertilizer is produced by automatic continuous vacuum filters like those used in Milwaukee, Houston, Chicago, Gastonia, N. C., Charlotte, N. C. Write for literature. Oliver United Filters Inc., 33 West 42nd St., New York, N. Y.

### Activation and Aeration

390. A booklet of value to sanitary and chemical engineers describes Norton Porous Mediums of bonded fused alumina (strong chemically stable, uniformly permeable) and their use in aeration of water and sewage. Norton Co., Worcester, Mass.

### Glass Covers

393. Full details regarding the use of Lord & Burnham Glass-Overs at Middletown, N. Y.; Marion, Ohio; Cleveland, Ohio; Freeport, N. Y.; Kitchener, Canada; West Chester, Pa., and other places are given in bulletins 22 to 33. Sent promptly on request to Lord & Burnham Co., Irvington, N. Y.

### Jointing Materials

402. Full details concerning No. 1 Korite for sealing sewer pipe joints so that they will be permanently tight. Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

### Manhole Covers and Inlets

403. Nuisance from loose, noisy manhole covers is eliminated by the use of Westeel rubber cushioned manhole covers and gratings. Six special advantages are explained in a new illustrated bulletin just issued by the West Steel Casting Co., 805 East 80th St., Cleveland, Ohio.

404. Street, sewer and water castings made of wear-resisting chilled iron in various styles, sizes and weights. Manhole covers, water meter covers, adjustable curb inlets, gutter crossing plates, valve and lamphole covers, ventilators, etc. Described in catalog issued by South Bend Foundry Co., South Bend, Ind.

### Meters, Sewage and Water

405. Just issued. Every sanitary engineer should have a copy of this new 32 page booklet describing the applications, types and distinctive features of the new Bailey meters for sewage treatment and water supply. Sent promptly. Bailey Meter Co., 1027 Ivanhoe Road, Cleveland, Ohio.

### Pipe Forms

407. Making concrete pipe on the job to give employment at home is the subject of a new booklet just issued by Quinn Wire and Iron Works, 1621 Twelfth St., Boone, Ia., manufacturers of "Heavy Duty" Pipe Forms. Sent promptly on request.

### Pumping Engines

413. "When Power Is Down," gives recommendations of models for standby services for all power requirements. Sterling Engine Company, Buffalo, N. Y.

### Screens, Sewage

417. The simple, automatic, Loughlin self-cleaning traveling screen is fully described in a new bulletin just issued by Filtration Equipment Co., 350 Madison Ave., New York, N. Y.

418. Sewage screens (Tark, Brunotte, and Straightline) for fine and coarse sewage; Straightline Collectors for Settling Tanks (Sludge, Scum and Grit), and Mechanical Aerators for activated sludge plants. Link-Belt Company, 910 So. Michigan Ave., Chicago, Ill. Book 642.

419. An illustrated booklet showing installations, and complete details regarding the 19 exclusive improvements which are featured in Shevlin Fine Disc Screens will be sent promptly by the Shevlin Engineering Co., Inc., 227 Fulton St., New York, N. Y.

420. A useful new bulletin for all those interested in sewage disposal, describing some of their proven equipment such as self-cleaning bar screens, grit conveyors, sludge collectors and shredders, has just been issued by the Jeffrey Mfg. Co., Columbus, Ohio. Includes diagrams and many illustrations.

### Screens

424. Water Screen Book No. 1252, describes water screens and gives complete technical information about them. Link-Belt Co., Chicago, Ill.

### Sludge Bed Glass Covers

426. Sludge Bed Glass Covers—"Super-Frame." Hitchings & Co., Main Office, Elizabeth, New Jersey. Offer A. I. A. File 101SB, describing glass covers for sludge and sprinkler beds; details, specifications and cost data.

### Sludge Conditioning

382. Full information concerning the experiences in the use of ferric chloride for use in sludge conditioning and in coagulating sewage will be sent promptly by Innis, Speiden & Co., 117 Liberty St., New York, N. Y.

### Treatment

429. A new series of bulletins describing their full line of sewage treatment equipment—Fine Screens, Schofield Bar Screens, Vacuum Filters for Sewage Sludge, Decarie Screenings Incinerators, Schofield Bar and Fine Screens, Vacuum Filters for Sewage Filtration and Pneumatic Ejectors for Sewage Screenings—are ready for distribution on request to Municipal Sanitary Service Corp., Room 2703, 155 East 44th St., New York, N. Y.

430. Separate bulletins showing their many lines of sewage treatment equipment will be sent promptly by The Pacific Flush Tank Co., Chicago and New York. The latest is No. 110 describing tray clarifiers.

431. Eliminate sludge bed troubles, forget about weather conditions, odor nuisance, hail insurance and the like. Full details as to how Oliver United Vacuum Filters overcome these problems will be sent to all interested by Oliver United Filters Inc., 33 West 42nd St., New York, N. Y.

433. Collectors and concentrators for modern sewage treatment plants, recent installations, and full data on aerators, and screens. Link-Belt Co., 910 So. Michigan Ave., Chicago, Ill., and Philadelphia.

## Index to Advertisements


| | |
|---|---|
| Adelphi Hotel | 40 |
| Allen & Vagtborg | 43 |
| Alvord, Burdick & Howson | 43 |
| Ambursen, Constr. Co. | 43 |
| Babcock Brothers | 43 |
| Barrett Co., The | Back Cover |
| Barstow & Le Feber | 43 |
| Black & Veatch | 43 |
| Browne, Floyd G. | 43 |
| Buffalo - Springfield Roller Co. | 32 |
| Burns & McDonnell Eng. Co. | 43 |
| Caird, James M. | 43 |
| Cramer, Robert | 43 |
| Dow, A. W. | 43 |
| Elrod, Henry E. | 43 |
| Filtration Equipment Co. | 41 |
| Firestone Tire & Rubber Co. | 6 |
| Frink, Mfr., Carl | 29 |
| Fuller & Everett | 43 |
| Fuller & McClintock | 43 |
| General Motors Truck Co. | 8 |
| Goodyear Tire & Rubber Co. | 51 |
| Graver Tank & Mfg. Co. | 38 |
| Greeley & Hansen | 43 |
| Green Co., Howard R. | 44 |
| Harrub Engineering Co., C. N. | 44 |
| Headley Asphalt Division | Front Cover |
| Hetherington & Berner, Inc. | 32 |
| Hill, Nicholas S., Jr. | 44 |
| Jaeger Machine Co. | 33 |
| Jeffrey Mfg. Co. | 2-3 |
| Kinney Mfg. Co. | 31 |
| LeRoy Tent & Awning Co. | 33 |
| Lewis Asphalt Engr. Co. | 40 |
| Link-Belt Co. | 42 |
| Linn Manufacturing Co. | 29 |
| Lord & Burnham Co. | 44 |
| Metcalf & Eddy | 44 |
| Mohawk Asphalt Heater Co. | 33 |
| Norton Co. | 34 |
| Pacific Flush Tank Co. | 40 |
| Pennsylvania Salt Mfg. Co. | 37 |
| Piccadilly Hotel | 38 |
| Pirnie, Malcolm | 44 |
| Potter, Alexander | 44 |
| Roberts Filter Mfg. Co. | 44 |
| South Bend Foundry Co. | 38 |
| Standard Oil Co. (Ind.) | 4 & 5 |
| Standard Oil Co. of N. Y. | 31 |
| Sterling Engine Co. | 38 |
| Taylor, Henry W. | 44 |
| West Steel Casting Co. | 40 |
| Wiedeman & Singleton | 44 |
| Wilson Engr. Co. | 44 |

# New Developments in Cost-Saving Equipment

***Three Machines to Make the Construction Dollar Do More Work***

## Improved Black Top Paver Handles Hot or Cold Mixes

An improved black top paver has been announced by the Adnun Engineering and Manufacturing Co. This machine offers many advantages in handling either hot or cold mixes and is responsible for an accuracy impossible to secure by hand.

The paver is self propelled and rolls on the sub-grade and finished course. It consists of a hopper mounted on a sturdy frame carrying an operating platform, engine, and attendant mechanism. The front end is supported by two wheels that are engine-driven and steered from the platform. The rear end is mounted on four rollers also powered and controlled for steering.

*Self-propelled, Adnun Black Top Paver in Operation.*

The truckload of material is backed between the front wheels and dumped to the hopper. An agitator bar at the bottom of the hopper draws the material down to the grade where it is cut off by a moving cutter bar similar to that of a mower.

An initial compression of the pavement is secured by the beveling of the underside of the cutter bar teeth. The machine lays pavement of any width and any thickness. It requires no forms, needs no preparation of shoulders, and will lay pavement right up to the road edge.

It has been used on practically every type of black top pavement, both hot and cold, and has demonstrated its ability to handle stiff mixes that have been standing and become lumpy, using lumps and all.

The peculiar action of the cutter bar strike-off makes it possible to lay an accurate abutting joint in laying parallel courses or in laying up to line of curb without raking or hand work.

Engineers and road builders desiring further information about this machine can obtain it from the Adnun Engineering & Mfg. Co., Nunda, N. Y.

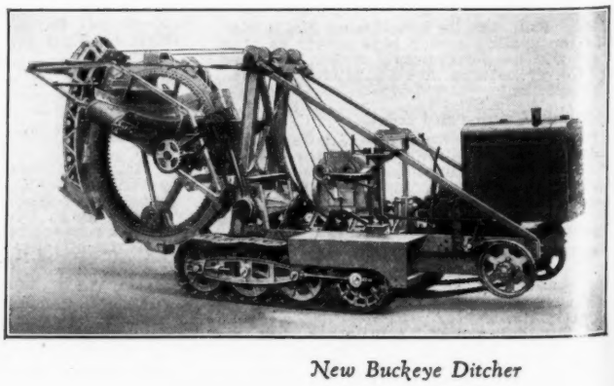
## New Small Ditcher for Fast Operation in Close Quarters

The Buckeye Traction Ditcher Company, Findlay, Ohio, has recently added a new model ditching and trenching machine. This Model 11 is the smallest of the Buckeye line—a service ditcher built for fast operation in cramped quarters, down alleys, across lawns, close to curbs—anywhere that laterals or other small trench up to 22 inches in width and 5½ feet deep need be dug.

Overall width of the machine is only 52 inches. It is mounted on full length Alligator traction units of the latest Buckeye design and may be turned completely around in its own length. As in other Buckeye Wheel type machines, the most important feature of the Model 11 is the rotary digging wheel.

This model can be operated at speeds that produce some remarkable footage records. When soil conditions are favorable, the smaller size of shallow trench may be dug at speeds up to 27 feet per minute. Through two selective four speed transmissions, 16 different gear ratios are instantly available. Further regulation of speed through the manually operated engine governor give an almost unlimited number of digging speeds ranging from 8 inches per minute on up. At the slower digging speeds, the Model 11 cuts its way easily thru the most difficult of soils. Nothing short of solid rock stops its progress.

The Model 11 is available in three different bucket widths, cutting trench 11½″ to 14½″, 14½″ to 18″, and 18″ to 22″. Buckets may be furnished for either rounding or square bottom ditch. The crumber and leveler at the rear of the cutting wheel assures a clean trench.



*New Buckeye Ditcher*

*Euclid Front End Loader attached to a 20 Cletrac Tractor.*

## Euclid Front End Loader Has Single Lever Control

The Euclid Front End Loader is a compact, balanced unit that can be easily and quickly attached to the standard or Hillside, 20, 25 or 35 Cletrac without drilling or altering the tractor.

The unit is hydraulically operated and is controlled by a single lever. Hydraulic operation gives positive action and the ability to hold the bucket in any position. The bucket automatically stops at its highest and lowest position and may be dumped at any desired height.

The tractor may be used for other work with the loader attached, or by the removal of two bolts on the lifter arms and the collars on the cross shaft the tractor can be quickly backed out of the bucket and push arms.

The Euclid Front End Loader does not use a vertical boom. This gives it a low overall height and permits operating through doors, and in other places where units with a vertical boom could not operate due to insufficient clearance.

The Front End Loader is designed to handle all kinds of bulk material. It is suitable for many types of excavation. It will clean ditches, cut light grades, handle small castings, foundry sand, coal, sand and gravel, factory waste, load snow around plants, railroads, municipalities and will perform innumerable other jobs around factories, railroads, on contractors' jobs and municipalities.

The size and shape of the bucket can be changed to suit conditions or types of material being handled. Further information can be obtained from the Cleveland Tractor Co., Cleveland, Ohio.